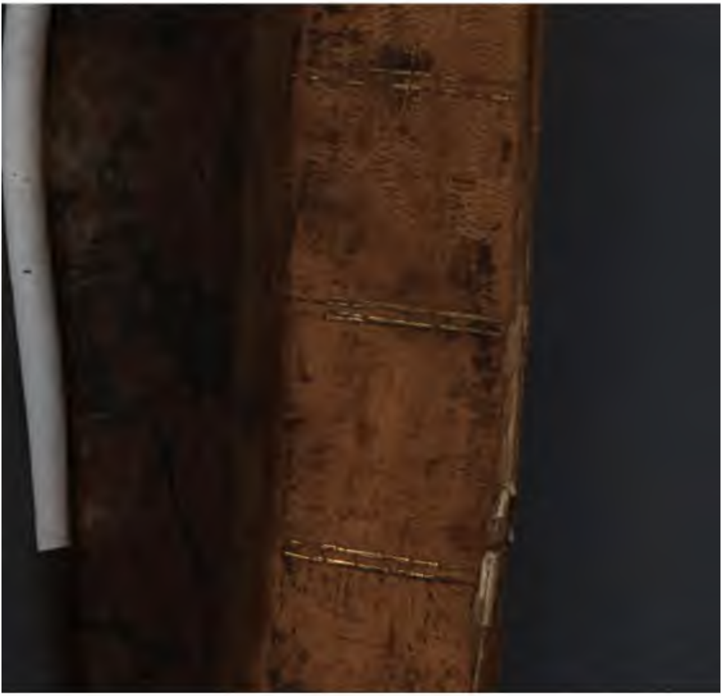

P. Mackintosh Esq
from his friend
Benj: H. Greene

New Haven Jany. 7th 1828

ARITHMETIC SIMPLIFIED:

BEING

A PLAIN, PRACTICAL SYSTEM,

ADAPTED TO THE CAPACITY OF YOUTH,

AND DESIGNED

FOR THE USE OF SCHOOLS,

IN THE

UNITED STATES.

IN TWO PARTS.

BY JOHN J. WHITE.

Second Edition.

HARTFORD:

PRINTED BY GEO. GOODWIN AND SONS.

1819.

RECOMMENDATIONS.

From the Rev. Abel Flint, Doctor of Divinity.

TO MR. JOHN J. WHITE,

Sir—I have read the System of Arithmetic which you are now publishing, and my opinion of it is, that it is peculiarly calculated to be useful in our common schools. The arrangement of the several rules, the explanations you have given of them, and the questions proposed for the learner to answer, give the book a preference to any which I have seen for the purpose which it is designed to answer; and the copiousness of examples will greatly facilitate the business of instructors.

Yours, &c.

ABEL FLINT.

Hartford, October 5, 1818.

From the Rev. Tillotson Bronson, &c.

MR. JOHN J. WHITE,

Sir—Having examined your book entitled "Arithmetic Simplified;" we are of opinion, that it is better adapted to the use of schools, than any work of the kind, which we have seen.

TILLOTSON BRONSON, *Principal of the Episcopal Academy.*

ASA CORNWALL, *Assistant Episcopal Academy.*

Cheshire, July 4th, 1819.

From the Rev. Jonathan M. Wainwright.

Hartford, August 6, 1819.

Sir—If my opinion can be of any service in giving currency to your book, I very cheerfully comply with your request. I have examined it, and think the system contained in it, the best adapted of any I have ever seen, to lead the young mind to a knowledge of figures.

Your obedient servant,

JONATHAN M. WAINWRIGHT.

MR. JOHN J. WHITE.

From the Rev. Henry Grew.

MR. JOHN J. WHITE,

Sir—I have looked over the second edition of the first part of your "Arithmetic Simplified;" the variations appear to me to be real improvements. I fully accord with the opinion already expressed by abler judges, that this work is well designed for the advantage both of teacher and pupil.

Your respectful friend,

HENRY GREW.

From the Rev. Elisha Cushman.

Hartford, August 2, 1819.

Sir—Agreeably to your request, I have perused your system of Arithmetic, and readily express my opinion, that it is calculated to be useful. As all correct systems of science are designed to illustrate principles existing in nature; it is desirable they should be so nearly adapted to the capacity of the learner, that their nature and utility may be readily perceived.

By the method you have adopted, Arithmetic may be with greater facility taught in schools; and, what is equally desirable, many of our youth whose circumstances do not favor a regular attendance on schools, but who are desirous of improving their leisure hours in the acquirement of useful knowledge, may be assisted in their pursuit.

Respectfully yours,

ELISHA CUSHMAN.

MR. JOHN J. WHITE.

From Isaac Perkins, Esq. Notary Public.

MR. JOHN J. WHITE,

Sir—Having examined your book, entitled "Arithmetic Simplified," I cheerfully embrace this opportunity of complying with your request, by expressing my opinion of the work.

It is proverbial of modern books, that each title page is as appropriate to all, as to either; but in this respect, you have most happily fulfilled your promise. Notwithstanding many small Arithmetics have been published, professedly for the use of common

schools; and though many of them are highly scientific and useful; so far as they have fallen under my observation, they appear to be particularly defective in the want of adaptation to the capacity of learners. In this particular, I consider your work entitled to the first commendation. Your method of impressing the rule on the memory of the scholar by questions, familiar explanations and examples in figures, is admirable, and will, while it relieves the teacher from great labour and expense of time, be to the scholar, engaging and familiar, as the oral instructions of the most accomplished master.

As the work is new, I have ventured thus far to characterize it, though with the fullest confidence, that my opinion will soon be merged in the approbation of the public.

I am, Sir, respectfully,

Yours, &c.

ISAAC PERKINS.

Hartford, October 5th, 1818.

From Mr. Amos Bull, Preceptor of a private Literary Academy.

The subscriber, having carefully examined Mr. WHITE's book, entitled "Arithmetic Simplified," is well pleased with it, and thinks it the best book of the kind he has ever seen, either for private use, or for the use of schools.

AMOS BULL.

Hartford, 6th October, 1818.

From Mr. Nathaniel Webb, Principal of a Public Literary Institution.

Hartford, Oct. 6th, 1818.

Dear Sir—I have examined your "Arithmetic Simplified;" as an elementary book, it is justly entitled to a preference to any I have ever seen on the subject. The rules are plain, the demonstrations perspicuous and satisfactory, the explanatory notes interspersed on almost every page, contribute greatly to its simplicity. I am also much pleased with your method of questioning; it is calculated to exercise the ingenuity as well as the memory of the scholar. Thoroughly convinced of its utility, I shall lose no time in introducing it into my school; and have no doubt, were it in general use, it would save

much time, and lessen the fatigues of the teacher, and also relieve the perplexity, and promote the improvement of the learner.

Wishing you all the success to which the merits of this book justly entitle you, I remain

Your obliged humble servant,

NATHANIEL WEBB.

MR. JOHN J. WHITE.

Westfield, Oct. 6th, 1818.

Dear Sir—I have given some attention to your work entitled "Arithmetic Simplified," and have formed a very favorable opinion of it. Many things which are generally perplexing to the young beginner, are here rendered quite perspicuous. I consider it a work well calculated for academies and schools, and hope it may find a generous patronage.

Yours, obediently,

FLAVEL S. GAYLORD, *Preceptor of Westfield Academy.*

MR. WHITE.

PREFACE

TO THE SECOND EDITION.

It is highly important that all elementary books of instruction, designed for the use of children, should be brought down to the level of their capacities. To this obvious consideration, the authors and compilers of most of the treatises on Arithmetic in general use, seem not sufficiently to have attended. Indeed, it is no easy task, to adapt our illustrations of an abstruse subject, and to accommodate our language to the feeble apprehension of the young. We forget the difficulties which embarrassed our early progress; and are apt to think, that because the rudiments of learning appear plain to us, they must, also, with a very little explanation, be equally so to them. In Arithmetic particularly, there is much, even with the best assistance, to perplex and discourage the young beginner.

Aware of these things from his own experience of many years, employed in the occupation of teaching, the author of the following treatise has earnestly attempted to fulfil the promise held out in his title page, of giving an "*Arithmetic Simplified*, or a plain, practical system, adapted to the capacity of youth." How far this promise has in reality been fulfilled, must be left to the decision of the public. So far as the quick sale of the first edition, and a loud demand for a second, goes to establish this point, he has no reason to fear that his efforts have been unsuccessful.

The chief difference (if the author may be allowed to judge) between his system and those in general use, is in the following respects, viz.

1. He has simplified the rules, by an accurate definition of the terms used, and by explaining the process by which each rule and case is managed, in plain and perspicuous language.

2. At the end of each rule he has added a number of questions involving in their answers all the points important to be retained in the pupil's memory. By this method, the labor of the teacher will be greatly lessened, by his having at hand all the questions he could wish to ask under each rule. The pupil, too, will learn his rule more thoroughly, by being obliged to understand it, in order to give a correct answer to the questions which may be demanded of him.

3. The examples are arranged in such order as to lead the pupil by an easy gradation from what is simple in the rule, to what is of greater difficulty; the first example under each rule and case being worked out, and the process explained in such a manner as to be intelligible to the weakest capacity.

If the author has been as successful as he flatters himself he has in the above particulars, not only will the labor of the preceptor in teaching, and of the pupil in learning be greatly facilitated, but a youth of tolerable capacity, deprived of the advantages of school education, may, with little or no assistance, obtain a knowledge of figures competent for the ordinary concerns of life. Besides these advantages which the author humbly conceives are peculiar to his work, he begs leave to call the attention of his reader to the following particulars, in which he has attempted to improve upon the systems in general use.

To the arithmetical characters have been given appropriate names, and each character has been explained by example.

The terms used in the several rules are placed next after the characters, and are again introduced with the rules to which they respectively belong.

There will be found throughout the work, many explanatory notes, calculated to assist the pupil in going from step to step without embarrassment.

To each rule is added such a variety of examples as will enable the teacher to select those which may best accord with the genius of his pupil.

The work is divided into two parts; some of which will be bound separately to accommodate young pupils with the first four rules, simple and compound, at half the price of the whole. Thus the second part will be saved from injury until it is brought into use.

To render this edition as perfect as possible, it has not only been corrected, improved and enlarged, but every example has been re-examined with the utmost care. An Appendix has also been added, containing the roots, &c. which more properly belong to the higher branches of mathematics. This appendix is copied from Hutton. Great attention has been given, to preparing the whole for the press; it is presumed, therefore, that few errors will be found.

Having thus given a general description of his work, the author submits it to the judgment of the public, in the humble hope, that it will meet with their approbation, and be found worthy of the patronage of those for whose use it was undertaken.

EXPLANATION OF CHARACTERS.

CHARACTERS.	EXPLANATIONS.
$=$	*Two parallel horizontal lines*, signify *equality:* and shew, that whatever precedes or is placed before them, is equal to whatever succeeds or is placed after them; as 5 and 9 are equal to 14; 12 pence are equal to 1 shilling. Examples, 5 and 9=14. 12 pence=1 shilling.
$+$	*St. George's Cross*, signifies *Addition:* as 7 and 8, are equal to 15. Example, $7+8=15$.
$-$	*One horizontal line*, signifies *Subtraction:* as 3 from 9, leaves, or is equal to 6. Example, $9-3=6$.
$\times$	*St. Andrew's Cross*, signifies *Multiplication:* as 6 times 8, is equal to 48. Example, $8\times6=48$.
$\div$	*A horizontal line between two points*, signifies *Division:* as 5 is in 40, 8 times; that is, the number of times 5 there is in 40, is equal to 8. Example, $40\div5=8$.
) (	*An inverted parenthesis*, signifies *Division* also: as 4 is contained in 24, 6 times. Example, 4)24(6.
$\frac{480}{16}$	*Numbers fractionwise*, denote *Division:* and signify that the upper number is to be divided by the lower, to find their value; as 16 is contained in 480, 30 times: that is, four hundred and eighty sixteenths, is equal to 30. Example, $480\div16=30$.
: :: :	*Four points*, signify *Proportion:* as 3 is to 6, so is 8 to 16; that is, 3 bears such proportion to 6, as 8 does to 16. Example, 3:6::8:16.

EXPLANATION OF TERMS.

TERMS IN NUMERATION.

A Figure or *Digit,* is expressive of so many ones.
A Cypher or *Ought,* denotes the want of a number.
Annex, is to place after.
Prefix, is to place before.

TERMS IN ADDITION.

Integer, is a simple or whole number.
Amount or *Sum,* is the number found by adding several together.

TERMS IN SUBTRACTION.

Minuend, is the greater number.
Subtrahend, is the less number.
Remainder, is the number left after subtracting.

TERMS IN MULTIPLICATION.

Multiplicand, is the number to be multiplied.
Multiplier, is the number to multiply by.
Product, is the number found by multiplying.
Factor, is either the multiplier or multiplicand.

TERMS IN DIVISION.

Dividend, is the number to be divided.
Divisor, is the number to divide by.
Quotient, is the number found by dividing.
Remainder, is the number left; less than the divisor.

TERMS IN FRACTIONS.

Fraction, is any part of an integer.
Mixed Number, is an integer and fraction.
Aliquot, is an even part of an integer.
Numerator, is the upper number of a fraction.
Denominator, is the lower number of a fraction.
A Simple Fraction, is when the numerator is less than the denominator.
An Improper Fraction, is when the numerator is greater than the denominator,
A Compound Fraction, is the fraction of a fraction.

TERMS IN INTEREST.

Interest, is a premium allowed for the use of money.
Principal, is the money lent.
Rate, is the sum per cent. agreed on.
Per Cent. or *Centum*, is by the hundred.
Per Annum, is by the year.
Amount, is both principal and interest added together.

TERMS IN TARE AND TRET.

Tare, is an allowance for the box or bag containing goods.
Tret, is an allowance of 4 lbs. on every 104 lbs.
Cloff, is an allowance of 2 lbs. on every 3 cwt.
Suttle, is when part of the allowance is made.
Neat Weight, is when all allowances are made.
Gross Weight, is the whole weight of goods, box, &c.

TERMS IN DISCOUNT.

Discount, is an allowance made for the payment of a sum before it becomes due.

Present Worth, is the value now, of a sum due some time hence.

TERMS IN EXCHANGE.

Exchange, is the changing of money, weight or measure of one country, to that of another.

Course of Exchange, is the current price of exchange.

Par of Exchange, is the value of money in one country, compared with that of another.

Real Money, is a piece of metal coined, as a dollar.

Imaginary Money, is a denomination of money, of which there is no real specie.

Bank or *Real Money*, is the standard currency of a country.

Current Money, is such as passes among merchants without discount.

Agio, is the difference between bank, and current money.

Usance, is the time allowed for the payment of bills of exchange.

Grace, is an allowance of three or more days, to the time mentioned in the bill.

ARITHMETIC.

Arithmetic, is the art or science of computing by numbers; and is comprised under six principal or fundamental rules, viz.—*Notation* or *Numeration*, *Addition*, *Subtraction*, *Multiplication*, *Division*, and *Proportion*.

Arithmetic, is of two kinds, *Theoretical*, and *Practical*.

Theoretical Arithmetic, explains the nature and quality of numbers; in this sense, it is a science.

Practical Arithmetic, shews the method of working by numbers; in this sense it is an art.

QUESTIONS.

What is Arithmetic? How many kinds of Arithmetic are there?
What does Theoretical Arithmetic teach?
What does Practical Arithmetic teach?

NUMERATION.

Numeration, teaches to read, write, or express any proposed number, by ten characters.

The characters, and their names, are as follows, viz.—

One.	Two.	Three.	Four.	Five.	Six.	Seven.	Eight.	Nine.	Cypher.
1	2	3	4	5	6	7	8	9	0

The first nine characters, are called *Figures* or *Digits*: the tenth, is called *Cypher* or *Ought*.

A Figure or *Digit*, is expressive of so many ones; and from the continual increase of one, all numbers are produced.

The Cypher or *Ought*, denotes the want of a number, and is (by itself) of no value; but when placed in any number, the figure or figures on its left hand, are thereby increased ten fold.

For example—4, is four; but annex* a cypher to it, thus, 40, it then becomes forty, or ten times 4; or two

* Annex, is to place after. Prefix, is to place before.

cyphers, thus, 400, it becomes four hundred, or one hundred times four; or thus, 404, is four hundred and four, &c.

The value of figures depends upon the place they stand in when joined together, reckoning from right to left.

The right hand place or figure of any number is called units; the second, tens; the third, hundreds; the fourth, thousands, &c. increasing from right to left, in a tenfold proportion: that is, any figure placed in the second column from the right, is ten times the value, as when placed in the first; and placed in the third column, ten times the value as when placed in the second, &c.

QUESTIONS.

What does Numeration teach?
What are the names of the characters?
By what other names are they distinguished?
What does a figure or digit express?
What does a cypher denote? Give an example.
What does the value of figures depend on?
What is the right hand figure, &c. of any number called?

NOTE.—Numeration or the art of numbering, is seldom, if ever sufficiently explained, to render it intelligible to new beginners. I shall therefore introduce several Tables; the first of which is a Counting table, that will teach how to count, and read numbers, from one, to one hundred.

COUNTING TABLE.

NOTE 1.—To learn this Table, begin at the top of the left hand column, and count, or read downwards, thus;—one, two, three, four, &c.

NOTE 2.—The value of each figure is placed at the head of the column in which it stands; and the value of each number is expressed in words on its right.

Units		Tens Units		Tens Units	
1=	One.	8=	Eight.	15=	Fifteen.
2	Two.	9	Nine.	16	Sixteen.
3	Three.	10	Ten.	17	Seventeen.
4	Four.	11	Eleven.	18	Eighteen.
5	Five.	12	Twelve.	19	Nineteen.
6	Six.	13	Thirteen.	20	Twenty.
7	Seven.	14	Fourteen.	21	Twenty-one.

Tens Units		Tens Units		Hun. Tens Units	
22=	Twenty-two.	49=	Forty-nine.	76=	Seventy-six.
23	Twenty-three.	50	Fifty.	77	Seventy-seven.
24	Twenty-four.	51	Fifty-one.	78	Seventy-eight.
25	Twenty-five.	52	Fifty-two.	79	Seventy-nine.
26	Twenty-six.	53	Fifty-three.	80	Eighty.
27	Twenty-seven.	54	Fifty-four.	81	Eighty-one.
28	Twenty-eight.	55	Fifty-five.	82	Eighty-two.
29	Twenty-nine.	56	Fifty-six.	83	Eighty-three.
30	Thirty.	57	Fifty-seven.	84	Eighty-four.
31	Thirty-one.	58	Fifty-eight.	85	Eighty-five.
32	Thirty-two.	59	Fifty-nine.	86	Eighty-six.
33	Thirty-three.	60	Sixty.	87	Eighty-seven.
34	Thirty-four.	61	Sixty-one.	88	Eighty-eight.
35	Thirty-five.	62	Sixty-two.	89	Eighty-nine.
36	Thirty-six.	63	Sixty-three.	90	Ninety.
37	Thirty-seven.	64	Sixty-four.	91	Ninety-one.
38	Thirty-eight.	65	Sixty-five.	92	Ninety-two.
39	Thirty-nine.	66	Sixty-six.	93	Ninety-three.
40	Forty.	67	Sixty-seven.	94	Ninety-four.
41	Forty-one.	68	Sixty-eight.	95	Ninety-five.
42	Forty-two.	69	Sixty-nine.	96	Ninety-six.
43	Forty-three.	70	Seventy.	97	Ninety-seven.
44	Forty-four.	71	Seventy-one.	98	Ninety-eight.
45	Forty-five.	72	Seventy-two.	99	Ninety-nine.
46	Forty-six.	73	Seventy-three.	100	One hundred.
47	Forty-seven.	74	Seventy-four.		
48	Forty-eight.	75	Seventy-five.		

NUMERATION TABLES.

NOTE.—This table shews that a cypher denotes the want of a number, and that every cypher annexed, increases the value of the figure on its left, ten fold.

Millions.	Hunds. of thou.	Tens of thou.	Thousands.	Hundreds.	Tens.	Units.	
						1	= One.
					1	0	= Ten.
				1	0	0	= One Hundred.
			1	0	0	0	= One Thousand.
		1	0	0	0	0	= Ten Thousand.
	1	0	0	0	0	0	= One Hundred Thousand.
1	0	0	0	0	0	0	= One Million.

NOTE 1.—The words at the head of this Table shew the value of those figures over which they stand, and should be committed to memory, beginning at the right hand, and reading towards the left.

NOTE 2.—This Table shews that any figure placed in the second column from the right, is ten times the value as when placed in the first, &c.

Thousands of Millions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	
									9	—Nine.
								9	8	—Ninety-eight.
							9	8	7	—Nine hundred and eighty-seven.
						9	8	7	6	—9 thousand, 876.
					9	8	7	6	5	—98 thousand, 765.
				9	8	7	6	5	4	—987 thousand, 654.
			9	8	7	6	5	4	3	—9 millions, 876 thousand, 543.
		9	8	7	6	5	4	3	2	—98 millions, 765 thousand, 432.
	9	8	7	6	5	4	3	2	1	—987 millions, 654 thousand, 321.
9	8	7	6	5	4	3	2	1	0	—Nine thousand eight hundred and seventy-six millions, five hundred and forty-three thousand, two hundred and ten.

NOTE 3.—Although this Table consists of only ten places or figures, yet it may be extended to many more, viz.—Tens of thousands of millions, hundreds of thousands of millions, billions, trillions, &c.

The following Table teaches how to read large numbers by pointing them off into periods of three figures each; the left hand figure of every three thus pointed off, is either hundreds of units, hundreds of thousands, or hundreds of millions, &c.

324—Three hundred and twenty-four.

751.642 { Seven hundred and fifty-one thousand, six hundred and forty-two.

892.120.614 { Eight hundred and ninety-two millions, one hundred and twenty thousand, six hundred and fourteen.

NOTATION BY LETTERS.

To learn which, begin at the left hand column, and read thus:—One I is one. Two II are two. Three III=3. IV=4, &c.

NOTE 1.—A less literal number placed before a greater, diminishes its value; but placed after, augments it, thus; IV is 4—VI is 6—IX is 9—XI is 11—XL is 40—LX is 60, &c.

One I is	1	XIV is	14	XC is	90
II	2	XV	15	C	100
III	3	XVI	16	CC	200
IV	4	XVII	17	CCC	300
V	5	XVIII	18	CCCC	400
VI	6	XIX	19	D	500
VII	7	XX	20	DC	600
VIII	8	XXX	30	DCC	700
IX	9	XL	40	DCCC	800
X	10	L	50	DCCCC	900
XI	11	LX	60	M	1000
XII	12	LXX	70	MDCCCXIX	1819
XIII	13	LXXX	80		

NOTE 2.—So often as any character is repeated, so many times its value is repeated.

EXAMPLES.

NOTE.—In writing down the following examples in characters and words, let it be observed; that wherever a number is wanting, I have placed a cypher; and wherever a cypher is given, the number wanting in that place is not expressed; and in expressing the numbers, I always begin with the left hand figure; and that every number expressed, has a similar one following it; and that the numbers are given in almost every form, from units, to millions.

Express in words the following numbers.

NOTE.—Half the numbers here given, are expressed in words; the other half are left for exercises.

5	=Five.
9	
40	Forty.
70	
149	One hundred and forty-nine.
853	
4004	Four thousand, and four.
6006	
30106	Thirty thousand, one hundred and six.
80702	
123045	One hundred and twenty-three thousand, and forty-five.
764081	
8000346	Eight millions, three hundred and forty-six.
9000753	
70000000	Seventy millions.
80000000	

Express in characters the following numbers.

NOTE.—Half the numbers here given are expressed in characters, the other half are left for exercises.

Six.	= 6
Eight.	
Fifty-seven.	57
Seventy-five.	
Four hundred and nine.	409
Nine hundred and four.	
Three thousand, three hundred and thirty.	3330
Five thousand, five hundred and fifty.	
Ninety-seven thousand, nine hundred.	97900
Seventy-nine thousand, seven hundred.	

Four hundred thousand.	= 400000
Two hundred thousand.	
One million, one thousand, and one.	1001001
Two millions, two thousand, and two.	
Fifty-five millions, five hundred and fifty-five thousand, five hundred and fifty-five.	55555555
Sixty-six millions, six hundred and sixty-six thousand, six hundred and sixty-six.	

SIMPLE ADDITION.

Simple Addition, is the putting or collecting together numbers of the same denomination, into one integer or whole sum.

Integer, is the simple or whole number.

Amount or *Sum*, is the number found by adding several together.

RULE.

Write down the numbers to be added, placing units under units, tens under tens, &c.

Begin with the lower unit figure—add up all in that column, and set down the whole amount, if it does not exceed nine.

If the amount exceeds nine, carry one for every ten; that is, set down the right hand figure of the amount, and the left hand figure or figures carry to the next column; which will be carrying one for every ten; for the left hand figure or figures of any sum, are equal to so many tens.

Proceed thus through every column; taking care to set down the whole amount of the last column.

Note.—Should the numbers to be added consist of unit figures only, set down their whole amount, and the work is done.

PROOF.

Begin at the top of the sum, and reckon downwards, in the same manner as it was added upwards; and if the work is right, this last amount will be equal to the first.

Or, cut off the upper row of figures, and find the amount of the rest; which set down under the amount of the whole; then add this last amount, and the upper line together, whose sum, if the work is right, will be equal to the first.

NOTE.—The reason of carrying one for every ten in all simple numbers, is, because 10 in an inferior column, is just equal to 1 in a superior column.

ILLUSTRATIONS.

1.

987
654
321
———
  12
 15
18
———
1962 Sum.
———

In the 1st illustration, the whole amount of each column is setdown, and their several amounts added together; which plainly shews, by comparing it with the 2d illustration, that setting down the right hand figure of the amount under each column, when it exceeds nine, and adding the left hand figure or figures, to the next column; will be carrying one for every ten; as they mutually prove each other.

2.

987
654
321
———
1962
———

QUESTIONS.

What is Simple Addition? What is meant by Integer?
What is amount or sum? How should we place figures to be added?
Where should we begin to add?
If the amount exceeds nine, how should we dispose of the figures?
How should we then proceed? How is Simple Addition proved?
Why do we carry for ten in Simple Addition, rather than for any other number?

ADDITION TABLE.

To learn which, begin at the left hand figure, and read thus:—2 and 2 are 4; 2 and 3 are 5, &c.

2+	2=	4	3+	7=	10	5+	5=	10	7+	7=	14
2	3	5	3	8	11	5	6	11	7	8	15
2	4	6	3	9	12	5	7	12	7	9	16
2	5	7	3	10	13	5	8	13	7	10	17
2	6	8	3	11	14	5	9	14	7	11	18
2	7	9	3	12	15	5	10	15	7	12	19
2	8	10	4+	4=	8	5	11	16	8	8	16
2	9	11	4	5	9	5	12	17	8	9	17
2	10	12	4	6	10	6+	6=	12	8	10	18
2	11	13	4	7	11	6	7	13	8	11	19
2	12	14	4	8	12	6	8	14	8	12	20
3+	3=	6	4	9	13	6	9	15	9	9	18
3	4	7	4	10	14	6	10	16	9	10	19
3	5	8	4	11	15	6	11	17	9	11	20
3	6	9	4	12	16	6	12	18	9	12	21

ADD THE NINE DIGITS TOGETHER.

Reckon upwards and say,

and 9	45	Sum total.
and 8	36	
and 7	28	
and 6	21	
and 5	15	
and 4	10	
and 3 =	6	
and 2 are	3	
One 1		
45		

Which place underneath the figures added.

Reckon downwards and say,

Nine 9		
and 8 are	17	
and 7 =	24	
and 6	30	
and 5	35	
and 4	39	
and 3	42	
and 2	44	
and 1	45	
45		Sum total.

Which proves the first operation.

Pupils, even whilst young, may be taught the nature of figures; particularly, the art of putting numbers together, by practising agreeable to the following Rule, and Examples.

RULE.

Let the pupil take one, or more cents into each hand, and tell how many cents each hand contains—then request the pupil to take the cents from the left hand into the right; and tell how many there are of the whole, &c.

EXAMPLES.

NOTE.—The first column below, represents the left hand—the second column the right—the third column the act of passing the contents of the left hand into the right—and the fourth column, represents the right hand holding the contents of both.

How many cents are there in the left hand.	How many in the right.	Take them all into the right hand.	Now tell me how many there are of the whole.
One	Two	+	Three
Three	One	+	Four
Two	Five	+	Seven
Six	Three	+	Nine
Four	Four	+	Eight
Seven	Six	+	Thirteen
Eight	Seven	+	Fifteen
Nine	Nine	+	Eighteen, &c.

NOTE.—Parents may pursue the above plan with their children, and preceptors with their pupils—But great care should be taken, not to ask such questions as would be difficult for them to answer—otherwise the pupil may be discouraged, and the good effect hereby contemplated, might be entirely defeated.

A similar method may also be practised in Subtraction.

Pupils may soon learn to put numbers together readily, so as not to hesitate, or stop to count, whilst adding up a column of figures, by attending to the following Rule, Illustrations, and Example.

RULE.

Recollect the amount of any two figures put together; then examine the following Illustrations, and they will shew, that if the amount of the first figure should be increased 10, their sum would be increased 10; and the right hand figure of each amount thus increased, will always be the same.

ILLUSTRATIONS.

1. If 4 and 5, are 9; 14 and 5, are 19; 24 and 5, are 29; 34 and 5, are 39; &c. It is therefore evident that so long as the amount should continue to be increased in the same ratio—the right hand figure 9, would continue to occupy the same place.

2. If 5 and 5, are 10; 15 and 5, are 20; 25 and 5, are 30; 35 and 5, are 40, &c.; thus, the Cypher, would continue stationary on the right hand.

3. If 7 and 6, are 13; 17 and 6, are 23; 27 and 6, are 33; 37 and 6, are 43, &c.; thus, the 3 would remain on the right.

4. If 9 and 8, are 17; 19 and 8, are 27; 29 and 8, are 37; 39 and 8, are 47, &c.—the right hand figure of each amount, in the several illustrations, is exactly the same.

EXAMPLE.

Note.—The foregoing Illustrations, are here reduced to practice.

Add the following figures, agreeable to the foregoing illustrations.

9
3
8
7
4
6
5
9
—
Amount, 51

Begin at the lower figure, and say; 9 and 5 are 14, and 6 is ——, 4 and 6 is 10; then 14 and 6 is 20, and 4 is 24, and 7 is ——, 4 and 7 is 11; then 24 and 7 is 31, and 8 is 39, and 3 is ——, 9 and 3 is 12; then 39 and 3 is 42, and 9 is ——, 2 and 9 is 11; then 42 and 9 is 51, the whole amount.

EXAMPLES.

Add the following sums together, and tell their amounts.

1.

and 2 are 5.
Say, 3

Am't. 5

2.

and 4 are
Say, 2

NOTE.—To find the amount of sum first, I begin with the lower figure and say; 3 and 2 are 5: which sum I set down underneath the figures added, and find the amount of 3 and 2, is equal to 5.

	3.	4.	5.	6.
	and 3 are	and 6 are	and 2 are	and 4 are
	Say, 5	Say, 3	Say, 7	Say, 4
Am't.				

	7.	8.	9.	10.	11.	12.
	8 9	6 8	5 4	4 3	6 0	5 5
	6 7	4 6	6 7	8 9	9 5	5 5
Am't.	1 5 6					

NOTE.—To find the amount of sum seventh, I begin with the lower unit figure, and say—7 and 9 are 16; I then set down 6, (the right hand figure of 16,) and the left hand figure 1, I add to the next column, thus: 1 to carry to 6 is 7, and 8 are 15; the whole amount of which I set down, and find the sum of 89 and 67, is equal to 156.

	13.	14.	15.	16.	17.
	3 4 5	9 8 7	3 4 5	7 6 5	9 8 9
	8 7 9	6 5 4	6 7 8	4 3 2	9 8 9
Am't.	1 2 2 4				
Proof,	1 2 2 4				

by addition.

NOTE.—To prove sum 13th, I begin at the upper unit figure, and say, 5 and 9 are 14; then 1 to carry to 4 is 5, and 7 are 12; then 1 to carry to 3 is 4, and 8 is 12: and find the second amount equal to the first, which proves the work to be right.

18.	
	1 2 3 4 5 6 7 8
	9 4 6 1 8 7 1 2
Sum,	1 0 6 9 6 4 3 9 0
Proof,	1 0 6 9 6 4 3 9 0

NOTE.—In this example, I begin with the lower unit figure, and say; 2 and 8 are 10; I then set down the cypher underneath the figures added, and carry the 1 to the next column, and say; 1 that I carry to 1 is two, and 7 are 9, &c.

19.	20.
9 8 7 6 5 4 3 2	9 9 9 9 9 9 9 9
9 8 7 6 5 4 3 2	8 7 6 5 4 3 2 1

21.	22.
9 0 8 0 7 0 6 0	7 2 8 6 5 4 1 8
1 2 3 4 5 6 7 8	9 7 5 3 1 0 8

23.

and 4 are 18.
and 6 are 14,
Say, 8

Amount, 1 8

NOTE.—To find the amount of sum 23d, I begin with the lower figure, and say; 8 and 6 are 14, and 4 are 18: which sum I set down underneath the figures added; and find the sum of 8, 6, and 4, is equal to 18.

24.

and 8 are
and 6 are
Say, 5

25.	26.	27.	28.
and 3 are	and 9 are	and 8 are	and 6 are
and 2 are	and 8 are	and 1 is	and 6 are
Say, 7	Say, 7	Say, 6	Say, 6

29.

	3 3 3 3 3 3 3 3
	7 0 6 0 5 0 3 0
	8 9 1 6 7 4 9 8
Sum,	1 9 3 1 0 5 8 6 1
	1 5 9 7 7 2 5 2 8
Proof,	1 9 3 1 0 5 8 6 1

NOTE.—In this example, I first add the whole three rows of figures together, and set down their amount; then cut off the upper row of figures, and add together the other two rows, and set down their amount; then add the second amount, and the upper row of figures together, and find this last amount equal to the first—which proves the work to be right.

30.

4 3 4 3 4 3 4 3
3 4 3 4 3 4 3 4
5 6 5 6 5 6 5 6

NOTE.—This, and the following examples, may be proved agreeable to the first, or last method of proof.

31.

6 4 0 0 3 2 4 6
9 1 8 3 6 0 2 1
7 6 5 4 3 2 1 0

32.

7 1 0 0 1 2 0 0
1 6 5 4 3 2 9 1
2 8 7 1 0 6 7 1

33.

and 4 are 16.
and 4 are 12,
and 4 are 8,
Say, 4

Am't. 16

NOTE.—To find the amount of sum 33d, I say; 4 and 4 are 8, and 4 are 12, and 4 are 16.

34.

and 4 are
and 3 are
and 2 is
Say, 1

35.

and 5 are
and 5 are
and 5 are
Say, 5

36.

and 8 are
and 7 are
and 6 are
Say, 5

37.

and 9 are
and 8 are
and 7 are
Say, 6

38.

and 8 are
and 8 are
and 8 are
Say, 8

39.	40.	41.
44444444	61616161	76543210
43333334	34343434	8234567
42222224	69696969	987654
44444444	21212121	12345

42.	43.	44.
10028600	26710234	40623100
45987347	167423	4967
82310060	821342	1020
21465789	98600275	12345678

45.

and 9 are 35.
and 8 are 26,
and 7 are 18,
and 6 are 11,
Say, 5

Am't. 35

NOTE.—To find the amount of sum 45th, I say; 5 and 6 are 11, and 7 are 18, and 8 are 26, and 9 are 35.

46.

and 4 are
and 5 are
and 6 are
and 7 are
Say, 8

47.	48.	49.	50.
and 3 are	and 6 are	and 5 are	7
and 4 are	and 5 are	and 4 are	7
and 5 are	and 4 are	and 3 are	7
and 6 are	and 3 are	and 2 is	7
Say, 7	Say, 2	Say, 1	7

51.	52.
55555555	80808080
50000005	70707070
50000005	60606060
50000005	50505050
55555555	40404040

53.	54.	55.	56.
and 1 is 21.	1 2	1 2 3	6 1 2 3 4 6
and 2 are 20,	3 4	4 5 6	6 5 6 7 8 6
and 3 are 18,	5 6	7 8 9	6 9 0 0 0 6
and 4 are 15,	7 8	1 2 3	6 1 2 3 4 6
and 5 are 11,	9 0	4 5 6	6 5 6 7 8 6
Say, 6	1 2	7 8 9	6 9 9 9 9 6
Am't. 2 1			

57.	58.
6 6	6 6 6 6 6 6 6 6
7 7 7	5 5 5 5 5 5 5
8 8 8 8	4 4 4 4 4 4
9 9 9 9 9	3 3 3 3 3
1 2 3 4 5 6	2 2 2 2
1 2 3 4 5 6 7 8	1 1 1

59.	60.	61.	62.
and 7 are 49.	7 7	1 2 3	7 7 7 7 7 7
and 7 are 42,	6 6	4 5 6	7 7 6 6 7 7
and 7 are 35,	5 5	7 8 9	7 7 5 5 7 7
and 7 are 28,	4 4	9 8 7	7 7 4 4 7 7
and 7 are 21,	3 3	6 5 4	7 7 3 3 7 7
and 7 are 14,	2 2	3 2 1	7 7 2 2 7 7
Say, 7	1 1	1 1 1	7 7 7 7 7 7
Am't. 4 9			

63.	64.	65.	66.
and 8 are 64.	8 8	1 2 3	4 8 8 8 8 4
and 8 are 56,	7 7	4 5 6	4 8 8 8 8 4
and 8 are 48,	6 6	7 8 9	4 8 8 8 8 4
and 8 are 40,	5 5	9 9 9	4 8 8 8 8 4
and 8 are 32,	4 4	8 8 7	4 8 8 8 8 4
and 8 are 24,	3 3	6 6 5	4 8 8 8 8 4
and 8 are 16,	2 2	4 4 3	4 8 8 8 8 4
Say, 8	1 1	2 2 1	4 8 8 8 8 4
Am't. 6 4			

67.	68.	69.	70.
and 9 are 81.	9 1	3 0 3	9 1 1 1 1 9
and 9 are 72,	8 2	3 9 3	9 1 2 2 1 9
and 9 are 63,	7 3	3 8 3	9 1 3 3 1 9
and 9 are 54,	6 4	3 7 3	9 1 4 4 1 9
and 9 are 45,	5 5	3 6 3	9 1 5 5 1 9
and 9 are 36,	4 6	3 5 3	9 1 6 6 1 9
and 9 are 27,	3 7	3 4 3	9 1 7 7 1 9
and 9 are 18,	2 8	3 3 3	9 1 8 8 1 9
Say, 9	1 9	3 2 3	9 1 9 9 1 9
Am't. 8 1			

71. Add 19+95+100+496 and 7456 together. *Sum*, 8166.

NOTE.—In setting down numbers to add, the largest number may be set down first, or last, as is most convenient.

72. Add 9, 1010, 4786, and 99999 together. *Sum*, 105804.

73. Add 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 together. *Sum*, 275.

74. Add fifty-five, sixty, sixty-five, seventy, seventy-five, eighty, eighty-five, ninety, ninety-five, and one hundred together. *Sum*, 775.

75. Add seven, eight, nine, seventy-six, ninety, five-hundred and sixty nine, and one thousand six hundred and ten together. *Sum*, 2369.

76. Add one million, one hundred thousand, ten thousand, one thousand, one hundred and ten together. *Sum*, 1111110.

PRACTICAL QUESTIONS.

1. If Hartford has 3955; New-Haven 5772; New-London 3238; Middletown 2014; and Norwich 2976 inhabitants; what is the population of those five cities? *Ans.* 17955.

2. James was born in the year 1794; in what year will he be 25 years old? *Ans.* 1819.

3. Suppose my friend borrowed of me at one time, ten dollars; at another time, twenty; at another, forty; at

another, eighty; at another, one hundred and sixty; and at another time, three hundred and twenty dollars; how many dollars did I lend him in the whole? *Ans.* 630

4. A merchant bought 55 barrels of beef, for 320 dollars; 70 barrels, for 505 dollars; and 120 barrels, for 975 dollars; how many barrels did he buy; and how many dollars did he pay for the whole?

Ans. { Bought 245 barrels.
Paid 1800 dollars.

5 What is the sum total of the following numbers? Viz.

Four thousand five hundred and fifty,
Two hundred and forty-seven thousand,
Nine hundred and thirty-six,
Seven millions and seven hundred. *Ans.* 7253186.

6. Suppose a steeple was broken off by the wind, 79 feet from the ground; the top part broken off, was 16 feet long; how high was the steeple before it was broken?

Ans. 95 feet.

7. If the distance from Portland to Boston, be 125 miles; from Boston to New-Haven, 162 miles; from New Haven to New-York, 88 miles; from New-York to Philadelphia, 95 miles; from Philadelphia to Baltimore, 102 miles; from Baltimore to Charleston, 716 miles; and from Charleston to Savannah, 119 miles; how many miles from Portland in Maine, to Savannah in Georgia?

Ans. 1407.

SIMPLE SUBTRACTION.

Simple Subtraction, teaches to take a less number from a greater, and thereby to find the difference.

TERMS.

Minuend, is the greater number.
Subtrahend, is the less number.
Remainder, is the number left after subtracting.

RULE.

Place the subtrahend under the minuend, units under units, tens under tens, &c.

Begin with the unit figures ; subtract the subtrahend from the minuend, and set down the remainder under the figure subtracted.

If the lower figure be greater than the upper, borrow ten, *i. e.* add ten to the upper figure ; subtract the lower figure from that sum, and set down the remainder ; then carry one, and add to the next figure in the subtrahend, for the ten which was borrowed, &c.

NOTE 1.—When any figure in the minuend is less than the figure under it in the subtrahend, the ten, which is added to the minuend, is the value of one in the next higher place ; and the one which is carried to the next figure in the subtrahend, diminishes so much the number in the remainder ; which is only taking ten from one place, and carrying one to the next higher, whereby the sum total is not changed.

NOTE 2.—Another method of borrowing is sometimes made use of ; *i. e.* when the figure in the subtrahend is greater than the one over it in the minuend ; subtract the lower figure from 10, then add the difference to the upper figure, which sum is placed in the remainder, and one carried to the next figure in the subtrahend, for the ten borrowed.

PROOF.

Subtract the first remainder from the minuend, and if the work is right, the second remainder will be equal to the subtrahend.

Or,add the remainder,and the subtrahend together,which sum if the work is right, will be equal to the minuend.

QUESTIONS.

What does simple Subtraction teach ?
Which number is the minuend ? Which is the subtrahend ?
Which is the remainder ?
How should figures be placed to subtract ?
Where should we begin to subtract ?
If the lower figure be greater than the upper, how should we proceed ?
What says Note 1st ? Note 2d ?
How is Simple Subtraction proved ?

SUBTRACTION TABLE.

To learn which, begin at the middle figure of the first three columns, and read thus ; 2 from 2 leaves 0 ; 2 from 3 leaves 1 ; 2 from 4 leaves 2, &c.

2	− 2	= 0	7	− 3	= 4	5	− 5	= 0	8	− 7	= 1
3	2	1	8	3	5	6	5	1	9	7	2
4	2	2	9	3	6	7	5	2	10	7	3
5	2	3	10	3	7	8	5	3	11	7	4
6	2	4	11	3	8	9	5	4	12	7	5
7	2	5	12	3	9	10	5	5	9	− 8	= 1
8	2	6	5	− 4	= 1	11	5	6	10	8	2
9	2	7	6	4	2	12	5	7	11	8	3
10	2	8	7	4	3	7	− 6	= 1	12	8	4
11	2	9	8	4	4	8	6	2	10	− 9	= 1
12	2	10	9	4	5	9	6	3	11	9	2
4	− 3	= 1	10	4	6	10	6	4	12	9	3
5	3	2	11	4	7	11	6	5	13	9	4
6	3	3	12	4	8	12	6	6	14	9	5

EXAMPLES.

Subtract the subtrahend from the minuend of the following sums, and tell their remainders.

	1.	2.
Min.	from 5 leaves 2.	from 6 leaves
Sub.	Say, 3	Say, 2
	—	—
Rem.	2	
	—	—

NOTE.—To find the remainder of sum 1st, I say; 3 from 5 leaves 2: which I place below the subtrahend, and find that after taking 3 from 5, 2 remains.

	3.	4.	5.
Min.	from 7 leaves	from 8 leaves	from 9 leaves
Sub.	Say, 6	Say, 2	Say, 4
	—	—	—
Rem.			
	—	—	—

	6.	7.	8.	9.	10.
Min.	2 6	3 9	4 1	6 8	8 9
Sub.	1 2	1 4	3 1	5 2	6 7
	——	——	——	——	——
Rem.	1 4				
	——	——	——	——	——

NOTE.—To find the remainder of sum 6th, I begin with the unit figure of the subtrahend, and say; 2 from 6 leaves 4, which I set down; then 1 from 2 leave 1: and find that after taking 12 from 26, 14 remains.

	11.	12.	13.	14.
Min.	8 7 6	4 5 6	5 8 7	9 1 2
Sub.	6 7 8	3 4 8	4 9 6	8 3 4
Rem.	1 9 8			

NOTE.—I find the remainder of sum 11th, by saying; 8 from 6 I cannot, but 8 from 16 leaves 8: then as I borrowed 10, I carry 1, *i. e.* I say; 1 that I carry to 7 is 8, from 7 I cannot, but 8 from 17 leaves 9: then 1 to carry to 6 is 7, from 8 leaves 1; the remainder is therefore 198; which is the difference between 678 and 876.

	15.	16.	17.	18.
Min.	4 0 6	3 4 8	9 2 7	9 8 7
Sub.	2 6 4	1 0 9	4 5 6	7 8 9
Rem.	1 4 2			

Proof, 2 6 4

by subtraction.

NOTE.—To prove sum 15th, I subtract the first remainder from the minuend, and find the second remainder equal to the subtrahend, which proves the work to be right.

	19.
Min.	6 4 9 7 5 2 8 3
Sub.	3 1 6 2 4 0 4 1
Rem.	3 3 3 5 1 2 4 2
Proof.	6 4 9 7 5 2 8 3

NOTE 1.—In this example I say; 1 from 3 leaves 2; which I set down: then 4 from 8 leaves 4, &c.

NOTE 2.—To prove the work, I add the remainder and subtrahend together, and find their sum is equal to the minuend, which proves the work to be right.

20.	21.	22.
98765432	61718191	91467890
87654321	12131415	2671462

23.	24.	25.
12300045	98767898	45216543
9060706	876789	987654

26.	27.	28.
40050060	10000000	10000000
80070	9999999	1

29.	30.	31.
11111111	10101010	12121212
2222222	1010101	434343

	From.		Take.		Remainder.
32.	98098	—	9999	=	88099
33.	10000	—	1111	=	8889
34.	12121	—	496	=	11625

35. From three hundred and twenty-seven; take one hundred and thirty-eight. 189 *Rem.*

36. From one thousand; take one hundred. 900 *Rem.*

37. From one million; take nine hundred and ninety-nine thousand. 1000 *Rem.*

38. From one million; take one. 999999 *Rem.*

39. From nine hundred and ninety-nine thousand; take nine hundred and ninety-nine. 998001 *Rem.*

PRACTICAL QUESTIONS.

1. Thomas is 20 years of age, and William is 9; how much older is Thomas, than William? *Ans.* 11 years.

2. Henry has a basket of apples, containing one hundred and ten; and Joseph has a basket containing sixty-five; how many more has Henry, than Joseph? *Ans.* 45.

3. How many years since America was discovered by Columbus, in 1492; to the present year 1817? *Ans.* 325.

4. Bought 200 barrels of flour, and sold 81; how many barrels have I left? *Ans.* 119.

5. If a Merchant has ten thousand dollars worth of goods, and owes three hundred and ninety-seven dollars; how much is he worth? *Ans.* $9603.

SIMPLE MULTIPLICATION.

Simple Multiplication, is the multiplying any two numbers together, without regard to their signification: It performs the work of many additions in the most concise manner.

TERMS.

Multiplicand, is the number to be multiplied.
Multiplier, is the number to multiply by.
Product, is the number found by multiplying.
Factor, is either the multiplier, or multiplicand.

Case 1.—*When the multiplier does not exceed* 12.

RULE.

Place the multiplier under the multiplicand, units under units, &c.

Multiply first the unit figure of the multiplicand, by the multiplier; and if the product does not exceed nine, set it down directly under the figure multiplied.

If the product exceeds nine, set down the right hand figure of the product, and carry the left hand figure, or figures to the next product, and so on through the whole; taking care to set down the whole amount of the last product.

PROOF.

Multiply the multiplier by the multiplicand, which product, (if the work is right) will be equal to the first.

Or, cast out the nines.

1st. Cast the nines out of the multiplicand, and set the excess at the right hand of a cross.

2d. Cast the nines out of the multiplier, and set the excess at the left hand of the cross.

3d. Cast the nines out of the product, and set the excess below the cross.

4th. Multiply the figures at the right and left of the cross together; cast the nines out of their product, and set the excess above the cross: which excess (if the work is right) will be equal to that below the cross.

Note.—Should either term be less than nine, set it down as before directed.

Case 2.—*When the multiplier exceeds* 12.

RULE.

Multiply by each figure in the multiplier separately. Place the right hand figure of each product directly under its multiplier, and carry the tens, to the next product. Then add all the several products together; and their sum, will be the total product, or answer.

Case 3.—*When the multiplier is a composite number, i. e. any number which may be produced by multiplying two numbers together.*

RULE.

Multiply first by one of the component parts; then that product by the other, and the last product will be the answer.

Case 4.—*When there are cyphers at the right hand of either the multiplier, multiplicand, or both.*

RULE.

Place the significant figures of the multiplier, directly under those of the multiplicand.

Multiply the significant figures only; then place as many cyphers to the right of the product, as there are in both, the multiplicand, and multiplier.

Case 5.—*When there are cyphers between the significant figures of the multiplier.*

RULE.

Multiply by the significant figures only; omit the cyphers, and place the right hand figure of every product, directly under the multiplier.

Case 6.—*When the multiplier is* 10, 100, 1000, *&c.*

RULE.

Bring down the multiplicand below the multiplier; then place as many cyphers to the right of the multiplicand, as there are in the multiplier; and the true product or answer is found.

QUESTIONS.

What is Simple Multiplication?

Which number is the Multiplicand? Which is the Multiplier?

Which is the Product? What are Factors?

How should figures be placed in simple multiplication?

What is then to be done?

If the product exceeds 9; how should it be disposed of?

How is simple multiplication proved?

When there are several figures in the multiplier; how is the total product found?

When the multiplier is a composite number; how should we proceed with it?

When there are cyphers at the right hand of the multiplier, or multiplicand, or both; what should be done with them?

When there are cyphers between the significant figures of the multiplier; how should we dispose of them?

When the multiplier is just 10, 100, 1000, &c., how should we proceed with it?

MULTIPLICATION TABLE.

To learn which, begin at the middle figure of the three first columns, and read thus; 3 times 3 are 9; 3 times 4 are 12; 3 times 5 = 15, &c.

3×	3=	9	8×	4=	32	7×	6=	42	10×	8=	80
4	3	12	9	4	36	8	6	48	11	8	88
5	3	15	10	4	40	9	6	54	12	8	96
6	3	18	11	4	44	10	6	60	9×	9=	81
7	3	21	12	4	48	11	6	66	10	9	90
8	3	24	5×	5=	25	12	6	72	11	9	99
9	3	27	6	5	30	7×	7=	49	12	9	108
10	3	30	7	5	35	8	7	56	10×	10=	100
11	3	33	8	5	40	9	7	63	11	10	110
12	3	36	9	5	45	10	7	70	12	10	120
4×	4=	16	10	5	50	11	7	77	11×	11=	121
5	4	20	11	5	55	12	7	84	12	11	132
6	4	24	12	5	60	8×	8=	64	12×	12=	144
7	4	28	6×	6=	36	9	8	72			

EXAMPLES.

Case 1.—*Where the multiplier does not exceed* 12.

Multiply the multiplicand, by the multiplier of the following sums, and tell their products.

	1.	2	3.	4.
Mul'd.	times 2 is 4.	times 3 is	times 4 is	times 5 is
Mul'r.	Say, 2	Say, 3	Say, 4	Say, 5
Product.	4			

	5.	6.	7.	8.
Mul'd.	times 6 is	times 7 is	times 8 is	times 9 is
Mul'r.	Say, 6	Say, 7	Say, 8	Say, 9
Product.	36			

	9.	10.	11.	12.
Mul'd.	times 10 is	times 11 is	times 12 is	0
Mul'r.	Say, 10	Say, 11	Say, 12	12
Product.	100			

NOTE.—I begin with sum 1st, and say; 2 times 2 is 4; then with sum 2d and say; 3 times 3 is —, &c.

	13.
Mul'd.	2 4
Mul'r.	2
Pro.	4 8

NOTE.—In this example, I say; twice 4 is 8; which I place under the multiplier: then twice 2 is 4; which I also set down: and find that twice 24, is equal to 48.

	2
	2 4
Proof,	4 8

To prove the work, I place the multiplicand under the multiplier, and say; 4 times 2 is 8: then twice 2 is 4; and find this second product equal to the first; which proves the work to be right.

by multiplication.

	14.
Mul'd.	7 6 5 4
Mul'r.	2
Pro.	1 5 3 0 8

NOTE.—In this example, I say; twice 4 is 8; which I set down: then twice 5 is 10; the ought I set down, and say, twice 6 is 12, and 1 to carry is 13: the 3 I set down, and say; twice 7 is 14, and 1 to carry is 15; the whole of which I set down.

	15.	16.
Mul'd.	9 8 7 6 5 4 3 2	1 2 3 4 5 6 7 8
Mul'r.	2	2
Pro.		

	17.
Mul'd.	9 7 5 3
Mul'r.	3
Pro.	2 9 2 5 9

NOTE.—In this example, I say; 3 times 3 is 9; then 3 times 5 is 15; then 3 times 7 is 21, and 1 to carry is 22; then 3 times 9 is 27, and 2 to carry is 29.

	18.	19.
Mul'd.	9 8 7 6 5 4 3 2	1 2 3 4 5 6 7 8
Mul'r.	3	3
Pro.	2 9 6 2 9 6 2 9 6	

20.	21.	22.
8 7 6 5 4 3 2 1	2 3 4 5 6 7 8 9	9 8 7 6 5 4 3 2
4	4	5
3 5 0 6 1 7 2 8 4		

23.	24.	25.
1 2 3 4 5 6 7 8	9 8 7 6 5 4 3 2	1 2 3 4 5 6 7 8
5	6	6
6 1 7 2 8 3 9 0		

26.	27.	28.
9 8 7 6 5 4 3 2	1 2 3 4 5 6 7 8	8 7 6 5 4 3 2 1
7	7	8
6 9 1 3 5 8 0 2 4		

29.	30.	31.
23456789	98765432	23456789
8	9	9
187654312		

32.	33.	34.
87654321	23456789	98765432
10	10	11
876543210		

35.	36.	37.
12345678	26702001	49768051
11	11	11
135802458		

38.	39.	40.
98765432	12345678	49710658
12	12	12
1185185184		

EXAMPLES.

Case 2.—*Where the multiplier exceeds* 12.

1.

Mul'd.	14678
Mul'r.	13
	44034
	14678
Pro.	190814

NOTE.—In this example, I multiply first by the unit figure of the multiplier; then by the tens figure, and place the product of the first figure directly under the figure I multiply by; I then add the two separate products together; which sum is the total product or answer.

*3

2.

Mul'd.	4 7 6 0 5
Mul'r.	1 4
	1 9 0 4 2 0
	4 7 6 0 5
	6 6 6 4 7 0

2

Proof, 5 × 4 by casting out the nines. 2

NOTE.—To prove the work of this sum, I begin at the left hand figure of the multiplicand, and say; 4 and 7 are 11; which is 2 over 9: then 2 and 6 are 8, and 5 are 13; which is 4 over 9: the 4 being the excess of nines, I place it at the right of the cross below: I then begin with the multiplier, and say; 1 and 4 is 5; there being no nines in 5, I place it at the left of the cross: I then cast the nines out of the product, and place the excess below the cross: I then multiply the figures at the right and left of the cross together, thus: 4 times 5 is 20: I then say, 2 and 0 is 2; there being no nines in 2, I place it above the cross, and find the upper number equal to the lower, which proves the work to be right.

3.	4.	5.
6954327	1068714	4896719
15	16	17
104314905	17099424	83244228

6.	7.	8.
6497462	4960239	8096147
18	19	20
116954316	94244541	161922940

9.	10.	11.
5160229	3671093	8964503
31	42	53
159967099	154185906	475118659

12.	13.	14.
9703679	1026746	3467862
64	75	86
621035456	77005950	298236132

15.	16.	17.
3294876	329106	789067
97	100	108
319602972	32910600	85219236

18.
408967
119
48667073

NOTE.—Here must be as many several products, as there are figures in the multiplier; and all those several products must be added together, to find the total product, or answer.

19.	20.	21.
987654	796124	467008
312	465	987
308148048	370197660	460936896

22.	23.	24.
460321	34869	91706
999	1234	8119
459860679	43028346	744561014

EXAMPLES.

Case 3.—*Where the multiplier is a composite number, i. e. a number which may be produced by multiplying two numbers together.*

Multiply	76719 by 24.	6×4=24.
	6	
		Proof.
6 times the mul'd.	460314	0
	4	6×3
		0
24 times the mul'd.	1841256 Product.	

NOTE.—As 4 times 6 is 24; I multiply first by 6, and that product by 4, which gives the answer.

	Multiply.		by.		Product.
2.	46038	×	35	=	1611330
3.	78466	×	49	=	3844834
4.	91738	×	81	=	7430778
5.	3964	×	121	=	479644
6.	8649	×	144	=	1245456

EXAMPLES.

Case 4.—*Where there are cyphers at the right hand of either the multiplicand, or multiplier, or both.*

1.

Mul'd.	4 9 6 7 0 0
Mul'r.	8 5 0
	2 4 8 3 5
	3 9 7 3 6
Pro.	4 2 2 1 9 5 0 0 0

5
4×8 Proof.
5

NOTE.—Here I place the significant figures of the multiplier under those of the multiplicand, and multiply by them only; but I place to the right of the product, as many cyphers as there were in both the multiplicand and multiplier.

	Multiply.		by.		Product.
2.	78000	×	600	=	46800000
3.	9604	×	190	=	1824760
4.	4670	×	276	=	1288920

EXAMPLES.

Case 5.—*Where there are cyphers between the significant figures of the multiplier.*

1.

Mul'd.	9 1 8 6 4 3
Mul'r.	7 0 0 5
	4 5 9 3 2 1 5
	6 4 3 0 5 0 1
Pro.	6 4 3 5 0 9 4 2 1 5

Proof.
3
3×4
3

NOTE.—Here I multiply by the significant figures only, omitting the cyphers altogether.

	Multiply.		by.		Product.
2.	6563275	×	5006	=	32855754650
3.	7369	×	37004	=	272682476
4.	154326	×	3007	=	464058282
5.	101010	×	1001	=	101111010

EXAMPLES.

Case 6.—*Where the multiplier is* 10, 100, 1000, *&c.*

1.

		Proof.
Mul'd.	6 7 0 1 2 4	
Mul'r.	1 0 0	2
		1×2
Pro.	6 7 0 1 2 4 0 0	2

NOTE.—Here I bring down the multiplicand below the multiplier; then place the cyphers in the multiplier on the right, of the product.

	Multiply.		by.		Product.
2.	467892	×	10	=	4678920
3.	96789	×	100	=	9678900
4.	4700	×	1000	=	

PROMISCUOUS EXAMPLES.

	Multiply.		by.		Product.
1.	75964	×	13	=	987532
2.	857389	×	999	=	856531611
3.	43486	×	6004	=	261089944
4.	19080	×	1000	=	19080000

5. Multiply three hundred and fourteen by twenty-five.
Product, 7850.

6. Multiply eight thousand three hundred and fifty-seven; by one thousand two hundred.
Product, 10028400.

7. Multiply one hundred and ninety-one thousand, six hundred and seventy-one; by three hundred and twenty.
Product, 61334720.

PRACTICAL QUESTIONS.

1. What would be the product of 950; multiplied by 36? *Ans.* 34200.

2. If a Farmer gave four hundred and ninety dollars per acre, for seventeen acres of land; what did the whole cost? *Ans.* $8330.

3. Suppose a town to contain 145 houses; each house 2 families, and each family consists of 6 inhabitants; how many inhabitants are there in the town? *Ans.* 1740.

4. Supposing a man's income to be 7 dollars per day; what would it amount to in a year, of 365 days? *Ans.* $2555.

5. In 36 regiments of 950 men each; how many troops are there in the whole? *Ans.* 34200.

6. Bought 150 bales of goods; each bale containing 49 pieces, and each piece 26 yards; how many yards are there in the whole? *Ans.* 191100.

SIMPLE DIVISION.

SIMPLE DIVISION, teaches to find how many times one number is contained in another, of the same name: it performs the work of many subtractions, in the most concise manner.

TERMS.

Dividend, is the number to be divided.

Divisor, is the number to divide by.

Quotient, is the number of times the divisor is contained in the dividend.

Remainder, is the number left after dividing; which is always less than the divisor.

Case 1.—*When the divisor consists of a significant figure, or figures only.*

RULE.

Place the divisor on the left, and the dividend between the lines of an inverted parenthesis.

Then find how many times the divisor is contained in a competent number of the first figures of the dividend; which number (when found) place in the quotient, at the right of the parenthesis.

Multiply the divisor by the quotient figure, and place the product under the figures which were taken for the first dividend.

Then subtract the product from the figures above, and bring down the next figure of the dividend to the right of the remainder, for a new dividend.

Divide, multiply, and subtract as before, until every figure in the dividend is brought down and divided.

The quotient, will be the number of times the divisor is contained in the dividend.

The remainder will be a fractional part of unit or one; which may be placed at the right of the quotient.

Note 1.—If after a figure is brought down from the dividend, and annexed to the remainder; should the number then, be still less than the divisor, place a cypher in the quotient, and bring down the next figure of the dividend, &c.

Note 2.—When the last figure of the dividend is annexed to the remainder; and the divisor should not be contained in that number; it will be the true remainder; and a cypher must be placed in the quotient, for the figure thus brought down.

Note 3.—The most ready way to find the true quotient figure, is to multiply the left hand figure of the divisor, by such a number (less than ten) as will produce nearly, but not exceed the amount of the two first figures of the dividend; which number will probably be the true quotient figure: if not, one less must be the right number.

Note 4.—Should the first figure, or the amount of the two first figures of the dividend, be less than the first, or the amount of the two first figures of the divisor; one more figure must be taken for the first dividend, than there is in the divisor; else the figures taken for a dividend will not measure the divisor.

Note 5.—When the divisor does not exceed 12, the work can be performed *mentally*, or by *Short Division*; in which case, the several quotient figures may be placed under their respective dividends.

PROOF.

Divide the dividend by the quotient, and if the work is right, the second quotient will be equal to the first divisor, and the second remainder the same as the first.

Or, multiply the divisor and quotient together; add in the remainder (if any) to the product; that sum, (if the work is right) will be equal to the dividend.

Or, add the remainder and all the products together, which sum (if the work is right) will be equal to the dividend.

Or, cast out the nines.

1st. Cast out the nines of the divisor, and place the excess at the right hand of a cross.
2d. Cast out the nines of the quotient, and place the excess on the left hand of the cross.
3d. Cast out the nines of the dividend, and place the excess below the cross.
4th. Multiply the figures at the right and left of the cross together, add their product to the remainder (if any after dividing); reject the nines from this sum, and place the excess above the cross: which excess, if the work is right, will be equal to that below the cross.

Case 2.—*When the divisor is a composite number; i. e. any number which may be produced by multiplying two numbers together.*

RULE.

Divide first, by one of the component parts, and that quotient by the other; the last quotient will be the answer.

Multiply the last remainder, by the first divisor; add in the first remainder (if any) to the product, and that sum will be the true remainder.

Case 3.—*When there is one, or more cyphers, at the right hand of the divisor.*

RULE.

Cut off the cyphers from the divisor; then cut off as many cyphers, or figures from the dividend, as were taken from the divisor.

NOTE.—After dividing the remaining figures of the dividend; those cut off, should be placed at the right of the last remainder.

Case 4.—*When the divisor is* 10, 100, 1000, *&c.*

RULE.

Cut off as many figures, or cyphers from the right hand of the dividend, as there are cyphers in the divisor; the figures thus cut off, will be the true remainder, and the left hand figures, the quotient.

QUESTIONS.

What does Simple Division teach?
What is meant by Dividend? What by Divisor?
What is meant by Quotient? What by Remainder?
How should the divisor and dividend be placed?
What is then to be done? How do we next proceed?
What is to be done with the product?
After subtracting the product from the dividend, what then?
What will the quotient be? What will be the remainder?
How is simple division proved?
What says Note 1st? Note 2d? Note 3d? Note 4th? Note 5th?
When the divisor is a composite number, how should we proceed with it? How is the true remainder found?
When there are cyphers at the right hand of the divisor, what should be done with them?
What should be done with the figures cut off?
When the divisor is 10, 100, &c. how should we proceed?

DIVISION TABLE.

To learn this Table, begin at the middle figure of the first three columns, and read thus; two's in two, once; two's in 4, twice, &c.

2	÷2	=1	8	÷4	=2	6	÷6	=1	16	÷8	=2
4	2	2	12	4	3	12	6	2	24	8	3
6	2	3	16	4	4	18	6	3	32	8	4
8	2	4	20	4	5	24	6	4	40	8	5
10	2	5	24	4	6	30	6	5	48	8	6
12	2	6	28	4	7	36	6	6	56	8	7
14	2	7	32	4	8	42	6	7	64	8	8
16	2	8	36	4	9	48	6	8	72	8	9
18	2	9	10	÷5	=2	54	6	9	18	÷9	=2
6	÷3	=2	15	5	3	14	÷7	=2	27	9	3
9	3	3	20	5	4	21	7	3	36	9	4
12	3	4	25	5	5	28	7	4	45	9	5
15	3	5	30	5	6	35	7	5	54	9	6
18	3	6	35	5	7	42	7	6	63	9	7
21	3	7	40	5	8	49	7	7	72	9	8
24	3	8	45	5	9	56	7	8	81	9	9
27	3	9				63	7	9			

EXAMPLES.

Case 1.—*Where most of the divisors consist of a significant figure, or figures only.*

Divide the dividend by the divisor of the following sums, and tell their quotients, and remainders.

1.

Divisor. is in Dividend. Quotient.

Say, 2) 6 (3 times.
6
—
Rem. 0

2.

Divisor. is in Dividend. Quotient.

Say, 2) 1 0 (times.
—

NOTE.—To find the quotient of sum 1st, I say; 2 is in 6, 3 times: which number I place to the right of the parenthesis. I then multiply the divisor by the quotient figure, and place the product below the dividend: I then say; 6 from 6 leaves 0, consequently there is no remainder.

3.

Div'r. is in Div'd. Quo.

Say, 3) 9 (times.
—

4.

Div'r. is in Div'd. Quo.

Say, 3) 1 2 (times.
—

5.

Div'r. is in Div'd. Quo.

Say, 4) 1 7 (4 times.
1 6
—
Rem. 1

6.

Div'r. is in Div'd. Quo.

Say 4) 2 2 (times.
—

NOTE.—In sum 5th, I say; 4 is in 17, 4 times: then 4 times 4 is 16; then 6 from 7 leaves 1, which is the remainder; for 4 is contained in 17, 4 times, and 1 over; which is equal to one 4th of 1.

7.

is in
Say, 5) 1 8 (times.

8.

is in
Say, 5) 2 7 (times.

9.

is in
Say, 6) 3 3 (5 times.
3 0

Rem. 3

10.

is in
Say 7) 2 5 (times.

NOTE.—In sum 9th, I say; 6 is in 33, 5 times: then 5 times 6 is 30: then 0 from 3 leaves 3: consequently, 33 will measure 6, 5 times; and leave a remainder of 3; which is equal to 3 sixths, or one half of one.

Proof of sum 9th, by division.

5) 3 3 (6
3 0

Rem. 3

NOTE.—To prove the work of sum 9th, I set down the dividend again, and place the quotient for a divisor: then say; 5 is in 33, 6 times: then 6 times 5 is 30: then 0 from 3 leaves 3: and find this quotient equal to the first divisor; and this remainder the same as the first; which proves the work to be right.

11.

is in
Say, 8) 3 3 (times.

12.

is in
Say, 9) 2 8 (times.

13.

Div'r. Div'd. Quo.
2) 8 5 7 (4 2 8
8

5
4

1 7
1 6

Rem. 1

NOTE.—In this example I say; 2 is in 8, (the 1st figure of the dividend,) 4 times; which number I place in the quotient; then 4 times 2 is 8, which I place underneath the 8, in the dividend; then (as nothing remains,) I bring down the next figure of the dividend, and say; 2 is in 5, 2; then twice 2 is 4, then 4 from 5 leaves 1. I then bring down the 7 to the right of the 1, which makes 17: I then say; 2 is in 17, 8 times; then 8 times 2 is 16; then 6 from 7 leaves 1: therefore 2 is contained in 857, 428 times, and 1 is left; which is equal to one half of one.

14.

Div'r. Div'd.
2)7695
Quo. 3847 : 1 rem.
2
Pr'f. 7695
by multiplication.

NOTE.—I divide this sum mentally, or by short division; and place the quotient figures under those of the dividend, thus: 2 is in 7, 3 and 1 over: then to the 1 left, I annex the 6 and say; 2 is in 16, 8; then 2 is in 9, 4 and 1 over; then 2 is in 15, 7 and 1 over.

To prove the work, I multiply the quotient by the divisor, and add the remainder into the first product; the total product being just equal to the dividend, proves the work to be right.

Work the 13th sum again, by Short Division.

Div'r. Div'd.
2) 857
Quo.

Work the 14th sum again, by Long Division.

Div'r. Div'd. Quo.
2) 7695 (

15.

Div'r. Dividend.
2) 1 6 7 1 4 2 7 Rem.
Quo. 8 3 5 7 1 3 : 1

16.

Div'r. Dividend.
2) 5 6 7 8 0 4 9 Rem.

17.

3) 4 6 0 2 8 5 0
1 5 3 4 2 8 3 : 1

18.

3) 8 0 7 0 6 0 5

19.

4) 9 4 7 0 8 6 9
2 3 6 7 7 1 7 : 1

20.

4) 3 6 4 9 0 1 6

21.

5) 1 9 6 3 2 8 0
3 9 2 6 5 6

22.

5) 6 3 0 1 2 9 1

23.

Div'r. Dividend. Rem.

6)9 2 8 7 0 6 1

Quo. 1 5 4 7 8 4 3 : 3

24.

Div'r. Dividend. Rem.

6)5 4 8 0 1 7 5

25.

7)8 4 3 9 6 5 2

1 2 0 5 6 4 : 4

26.

7)6 9 7 0 3 8 4

27.

8)1 6 7 0 0 6 1

2 0 8 7 5 7 : 5

28.

8)6 7 9 0 8 6 4

29.

9)7 6 8 1 2 7 0

8 5 3 4 7 4 : 4

30.

9)9 8 7 6 5 4 3

31.

10)3 0 9 1 7 0 1

3 0 9 1 7 0 : 1

32.

10)3 9 4 8 5 7 6

33.

11)6 7 0 2 4 9 8

6 0 9 3 1 8

34.

11)1 0 2 0 3 0 4

35.

12)7 4 8 1 0 2 6

6 2 3 4 1 8 : 10

36.

12)1 1 9 1 1 8 1

37.

```
Div'r. Div'd. Quo.
 13)6749(519
    65
    ---
     24
     13
     ---
     119
     117
     ---
Rem.   2
```

NOTE.—In this example, I first enquire how many times 13, there are in 67; which I find to be 5, and place it in the quotient: I then multiply the divisor by it, and place the product under the 67; I then subtract the product from the 67, and find 2 remainder; I then bring down the next figure of the dividend to the right of the remainder; then enquire how many times the divisor is contained in 24, which is but once: I thus continue to divide, multiply, and subtract, until every figure of the dividend is brought down and divided; the figures in the quotient, are the number of times the divisor is contained in the dividend; the 2 remaining, is 2 thirteenths of one.

38.

```
Div'r. Div'd. Quo.
 14)9678(691
    84*
    ---
    127
    126*
    ----
      18
      14*
      ---
Rem.   4*
    ------
    9678 Proof by addition.
```

NOTE.—To prove the work of this example, I add the remainder, and all the several products together; and find their sum is just equal to the dividend.

The remainder, and the several products are here marked with asterisms, thus.*

39.

```
Div'r. Div'd. Quo.
 13)9146(703


          ---
        7 Rem.
```

40.

```
Div'r. Div'd. Quo.
 14)9678(
    84
    ---
    117
    116
    ---
      18
      14
      ---
       4 Rem.
```

NOTE.—In sum 39th, I have placed the quotient and remainder, and left the products for the exercise of the pupil.

NOTE.—In sum 40th, I have placed the products and remainder; and left the quotient for the exercise of the pupil.

41.

Div'r.	Div'd.	Quo.	Rem.
15)3 6 7 8 0(2 4 5 2			0

42.

Div'r.	Div'd.	Quo.	Rem.
16)1 9 0 8 6(1 1 9 2			14

	Divide.		by.		Quo.		Rem.
43.	1467023	÷	17	=	86295	:	8
44.	4670464	÷	18	=	259470	:	4
45.	1240710	÷	19	=		:	10
46.	9108621	÷	20	=		:	1

47.

```
23)48130(2092
   46
   ---
    213
    207
    ---
      60
      46
      --
Rem.  14
         7
Proof. 4×5
         7
```

NOTE.—I prove this sum by casting out the nines; first from the divisor, and placing the excess (if any) to the right of the cross; then from the quotient, placing the excess at the left of the cross: then from the dividend, placing the excess below the cross; then by multiplying the figures at the right and left of the cross together—adding the remainder to that product, rejecting the nines, (if any,) from that sum, and placing the excess above the cross; which excess being equal to the one below the cross, proves the work to be right.

48.

Div'r.	Div'd.	Quo.	Rem.
25)3 9 6 0 0(1 5 8 4			0

49.

Div'r.	Div'd.	Quo.	Rem.
34)9 3 0 1(2 7 3			19

	Divide.		by.		Quo.		Rem.
50.	1463901	÷	45	=	32531	:	6
51.	7010736	÷	56	=		:	40
52.	943406	÷	67	=		:	46
53.	10610	÷	78	=		:	2
54.	1000000	÷	89	=		:	85

55.

```
Div'r.   Div'd.     Quo.
132)2 2 9 2 1(1 7 3
    1 3 2*
    -----
      9 7 2       7
      9 2 4*     2×6  Proof, by rejecting the nines.
      -----       7
        4 8 1
        3 9 6*
        -----
          8 5*  Rem.
    ---------
    2 2 9 2 1   Proof, by addition.
    ---------
```

NOTE.—I have proved the work of this sum two ways, viz.—by addition, and by casting out the nines; both of which methods are very simple, and readily done.

	Divide.		by.		Quo.		Rem.
56.	79165238	÷	238	=	332627	:	12
57.	253622	÷	422	=		:	0
58.	974932	÷	365	=		:	17
59.	1674980	÷	1067	=		:	857
60.	86023987	÷	999	=		:	97

EXAMPLES.

Case 2.—*Where the divisor is a composite number, i. e. a number which may be produced by multiplying two numbers together.*

```
Div'r.   Div'd.
      4)6 7 8 9 7 0 2
        -------------
      6)1 6 9 7 4 2 5 : 2, first Rem.
        -------------
Quo.    2 8 2 9 0 4 : 1, last Rem.
           Multiply by  4, first Divisor.
                        --
                        4, Product.
                    Add 2, first Rem.
                        --
                 Amount 6, true Rem.
```

NOTE.—4 times 6, is equal to 24; therefore, 4 and 6, are the proper divisors.

	Divide.		by.		Quo.		Rem.
2.	349670	÷	36	=	9713	:	2
3.	4049712	÷	48	=	84369	:	0
4.	937387	÷	54	=		:	1
5.	7014596	÷	72	=		:	68
6.	1575360	÷	144	=		:	0

EXAMPLES.

Case 3.—*Where there are cyphers at the right hand of the divisor.*

1.

Div'r. Div'd. Quo.
2 9 | 0)3 5 0 6 7 | 9(1 2 0 9
2 9
——— Proof.
6 0 3
5 8 3×2
——— 3
2 6 7
2 6 1
———
6 9 Rem.

Note.—Here I cut off the cypher from the divisor, and a figure from the dividend; I then divide the rest of the dividend by 29, and bring down the 9 which I cut off from the dividend, to the right of the remainder 6, which makes 69; the true remainder.

2.

Div'r. Div'd.
2 | 0 0)3 6 7 0 | 9 3(
———————
Quo. 1 8 3 5 : 9 3 Rem.
2 0 0
———————
Proof. 3 6 7 0 9 3

Note.—Here I prove the work by multiplication; which is the readiest way, when the divisor does not exceed 12; as is the case here, after cutting off the cyphers.

	Divide.		by.		Quo.		Rem.
3.	67853	÷	350	=	193	:	303
4.	7380964		23000		320		20964
5.	247369		7300				6469
6.	76173		320				13

EXAMPLES.

Case 4—*Where the divisor is* 10, 100, 1000, *&c.*

1. Divide 46701 by 10.

1 | 0)4 6 7 0 | 1 Rem.
Quotient.

NOTE.—As there is in this example but one cypher in the divisor, there was but one figure to cut off from the dividend, which is the remainder; and the left hand figures the quotient.

	Divide.		by.		Quo.		Rem.
2.	167891	÷	10	=	16789	:	1
3.	631043	÷	100	=	6310	:	43
4.	140876	÷	1000	=		:	
5.	987654	÷	10000	=		:	

PROMISCUOUS EXAMPLES.

	Divide.		by.		Quo.		Rem.
1.	69540	÷	25	=	2781	:	15
2.	6203946	÷	5700	=		:	2346
3.	7400000	÷	475	=	15578	:	450
4.	491678	÷	100	=		:	78
5.	987654	÷	999	=		:	642
6.	100000	÷	1000	=		:	0
7.	3867123	÷	4323	=		:	2361

8. Divide twelve thousand, eight hundred and fifty-six; by nine. *Ans.* 1428 : 4.

9. Divide three thousand, two hundred and sixty-four; by twenty-four. *Ans.* 136.

10. Divide forty-nine thousand, four hundred and ninety; by forty-nine. *Ans.* 1010.

11. Divide one million; by one hundred thousand. *Ans.* 10.

PRACTICAL QUESTIONS.

1. If 27 barrels of pork, cost 675 dollars; how much is that per barrel? *Ans.* 25 dollars.

2. If I divide one thousand four hundred and ninety-one dollars, equally among seven men; what would be the share of each? *Ans.* 213 dollars.

3. If 8514 dollars, is to be divided amongst a ship's crew, consisting of 387 men; what would each man receive? *Ans.* 22 dollars.

4. The President of the United States has a salary of 25,000 dollars, a year; how much is that per day, allowing 365 days to the year? *Ans.* 68 dollars per day, and 180 dollars left.

5. If 18950, be divided by 25; what would be the quotient? *Ans.* 758.

COMPOUND ADDITION.

Compound Addition, is the putting together several numbers, having different denominations; as dollars, cents, and mills—pounds, shillings, pence, and farthings—tons, hundreds, quarters, &c.

TERMS.

Amount, or *Sum*, is the number found by adding several of one, or more denominations together.

RULE.

Place the numbers to be added, so that those of the same denomination, may stand directly under each other.

Add the figures of the lowest denomination together, as in simple addition.

When the sum is not equal to the number it takes of that denomination to make one of the next higher; set it down under the figures added.

If the sum equals, or exceeds that number, divide it by so many of that denomination as make one of the next higher; set down the remainder (if any) under the figures added, and carry the quotient to the next higher denomination.

Proceed as before directed through all the different denominations, to the highest or last denomination, which add, and set down, as in simple addition.

PROOF.

Begin at the top of the sum and reckon downwards, carrying as before directed; and if the work is right, this last sum will be equal to the first.

Or, cut off the upper row of figures, proceed with the rest as before; to this second amount add the upper row of figures; which sum if the work is right, will be equal to the first.

NOTE 1.—Accounts are kept in several commercial countries, in pounds, shillings, pence, and farthings; it is necessary therefore that we should be familiar with them.

NOTE 2.—When £ is prefixed to a sum, all the figures to the first separating point, are pounds; those between the first and second points, are shillings; those between the second and third points, are pence; those figures to the right of the pence, are farthings.

NOTE 3.—When D., or this character $ is prefixed to a sum, all the figures to the first point, are dollars; those between the first and second points, are cents; those to the right of the cents, are mills.

QUESTIONS.

What is Compound Addition? What is amount, or sum?

How are the different denominations to be placed in compound addition?

What is the rule for adding them together?

When a column of any denomination is added up; what is then to be done?

If the sum equals or exceeds that number, what then is to be done?

How do we then proceed? How is compound addition proved?

Great advantage may be derived from committing the following tables to memory; without which, the common business of life cannot be transacted to advantage. The questions following the tables, will be of great assistance to the pupil.

SHILLINGS, AND PENCE TABLE.

NOTE.—Read the left hand side of this table, thus; 20 pence is 1 shilling and 8 pence, &c.—The right hand side thus; 1 shilling is 12 pence, &c.

PENCE TABLE. SHILLINGS TABLE.

d.		s.	d.	d.		s.	d.	s.		d.	s.		d.
20	=	1	8	80	=	6	8	1	=	12	7	=	84
30		2	6	90		7	6	2		24	8		96
40		3	4	100		8	4	3		36	9		108
50		4	2	110		9	2	4		48	10		120
60		5	0	120		10	0	5		60	11		132
70		5	10					6		72	12		144

QUESTIONS.

PENCE TABLE.—*How much is 20 pence, &c.*
SHILLINGS TABLE.—*How many pence in 1 shilling, &c.*

FEDERAL MONEY.

The denominations of Federal Money, are; Eagles, Dollars, Dimes, Cents, and Mills.

10 Mills (m.)	make	1 Cent, c.
10 Cents	——	1 Dime, d.
10 Dimes	——	1 Dollar, D. or $.
10 Dollars	——	1 Eagle. E.

Accounts in the United States, are usually kept in dollars, cents, and mills.

10 Mills,	make	1 Cent.
100 Cents,	——	1 Dollar.

NOTE 1.—Exchanges are negociated in the United States by the dollar.

NOTE 2.—The names of the coins less than a dollar, are expressive of their values, viz.

Mill, is contracted from Mille, the Latin for Thousand.
Cent, from Centum, the Latin for Hundred.
Dime, from Disme, the French for Tenths.

NOTE 3.—The weight of an Eagle is 270 grains, standard gold.
The weight of a dollar, is 416 grains, standard silver.
The subdivisions are in the same proportion.

NOTE 4.—Standard Gold is 11 parts pure, and 1 Alloy.
Standard Silver, is 1485 parts pure, and 179 Alloy.

NOTE 5.—A pound of pure Gold, is valued at 15 pounds of pure Silver.

NOTE 6.—Federal Money increases in a tenfold proportion like whole numbers; it is therefore easier to reckon, than the money of any other country, except China.

QUESTIONS.

What are the denominations of Federal Money?
How many Mills make a Cent, &c.?
Which of those denominations of money are used in accounts?
By which of those denominations, are exchanges negotiated in the United States?
From what are the names of Federal coin derived?
What is the weight of an Eagle? What is the weight of a Dollar?
What part of standard Gold is pure, and what alloy?
What part of standard Silver is pure, and what alloy?
How many pounds of Silver, are equal to one pound of Gold?

ENGLISH MONEY.

The denominations of English Money, are ;—Pounds, Shillings, Pence, and Farthings.

4	Farthings (qrs.)	make	1 Penny, d.
12	Pence	——	1 Shilling, s.
20	Shillings	——	1 Pound, £.

NOTE 1.—Accounts in England, (and by some in the United States,) are kept in Pounds, Shillings, and Pence.

NOTE 2.—Exchanges are negotiated in England, by the Pound Sterling.

NOTE 3.—The characters used in English Money, are derived from the Latin : viz.

£. from Libra, the Latin for Pounds.
s. from Solidi, the Latin for Shillings.
d. from Denarii, the Latin for Pence.
qrs from Quadrantes, the Latin for Farthings.

4.—A Pound Sterling, is equal to \$4 44$\frac{4}{9}$ Fed. Money.
An English Shilling, = 22$\frac{2}{9}$ —— ——
4s. 6d. Sterling, = \$1 —— ——
A Groat, is 4 Pence, both here, and in England.

NOTE 5.—In England, Dollars are sometimes sold as Bullion ; by Weight.

NOTE 6.—The Standard for Gold and Silver, and their intrinsic value in Great-Britain, is the same as in the United States.

QUESTIONS.

What are the denominations of English Money ?
How many Farthings make a Penny, &c. ?
By what denomination of money are Exchanges negotiated in England ?
From what are the characters used in English Money derived ?
What is the value of a Pound Sterling, in Federal Money ?
What is the value of an English Shilling, in Federal Money ?
How much Federal Money is equal to 4s. 6d. Sterling ?
How much is a Groat ? How are Dollars disposed of in England ?
What is the Standard, and value of Gold and Silver, in Great-Britain ?

TROY WEIGHT.

The denominations of Troy Weight, are ;—Pounds, Ounces, Penny-weights, and Grains.

24	Grains, (grs.)	make	1 Penny-wt. pwt.
20	Penny-wt.	-	1 Ounce, oz.
12	Ounces	-	1 Pound, lb.

NOTE 1.—By this weight are weighed Gold, Silver, Jewels, Liquors, &c.

NOTE 2.—A Pound Avoirdupois is heavier than a Pound Troy; but an ounce Troy is heavier than an ounce Avoirdupois.

NOTE 3.—175 oz. Troy are equal to 192 oz. Avoirdupois.
175 lb. Troy are equal to 144 lb. Avoirdupois.

NOTE 4.—5760 Grains = 1 lb. Troy.
7000 Grains = 1 lb. Avoirdupois.
480 Grains = 1 oz. Troy.
437½ Grains = 1 oz. Avoirdupois.

QUESTIONS.

What are the denominations of Troy Weight?
How many Grains make a Penny-Weight, &c.?
What goods are weighed by Troy Weight?
Which is the heaviest, a pound Troy, or a pound Avoirdupois?
What proportion does Troy Weight bear to Avoirdupois?
How many Grains, in a pound Troy, &c.?

AVOIRDUPOIS WEIGHT.

The denominations of Avoirdupois Weight, are;—Tons, Hundreds, Quarters, Pounds, Ounces and Drams.

16	Drams (dr.)	make	1 Ounce, oz.
16	Ounces	-	1 Pound, lb.
28	Pounds	-	¼ of a Hund., qr.
4	Quarters	-	1 Hundred, Cwt.
20	Hundred	-	1 Ton, T.

NOTE.—By this weight are weighed all kinds of coarse, and heavy goods, except gold, silver, &c.

QUESTIONS.

What are the denominations of Avoirdupois Weight?
How many drams make an ounce, &c.?
What articles are weighed by Avoirdupois Weight?

APOTHECARIES WEIGHT.

The denominations of Apothecaries Weight, are;—Pounds, Ounces, Drams, Scruples, and Grains.

20	Grains (gr.)	make	1 Scruple, ℈.
3	Scruples	-	1 Dram, ʒ.
8	Drams	-	1 Ounce, ℥.
12	Ounces	-	1 Pound, ℔.

NOTE 1.—The Apothecaries' pound and ounce, and the pound and ounce Troy, are the same, only differently divided and subdivided.

NOTE 2.—Medicines are mixed by this rule; but the Apothecaries buy and sell their commodities by Avoirdupois Weight.

QUESTIONS.

What are the denominations of Apothecaries Weight?
How many Grains make a Scruple, &c.?
What is the difference between Apothecaries Weight and Troy Weight?
What is the use of this Weight?

CLOTH MEASURE.

The denominations of Cloth Measure, are; Yards, Quarters, Nails, and Inches.

$2\frac{1}{4}$	Inches (in.)	make	1 Nail, na.
4	Nails	-	$\frac{1}{4}$ of a Yard, qr.
4	Quarters	-	1 Yard, yd.

ALSO,

3	Quarters	make	1 Ell Flemish, E. Fl.
5	Quarters	-	1 Ell English, E. E.
6	Quarters	-	1 Ell French, E. Fr.

NOTE.—The Yard is used in measuring all kinds of piece goods in the United States.

QUESTIONS.

What are the denominations of Cloth Measure?
How many inches make a nail, &c.?
How many quarters make an Ell Flemish?
How many quarters make an Ell English?
How many quarters make an Ell French?
What is the use of Cloth Measure?

LONG MEASURE.

The denominations of Long Measure, are; Degrees, Miles, Furlongs, Rods, Feet, Inches, and Barley-Corns.

ALSO,

Miles, Furlongs, Chains, Rods. Links, and Inches.

3	Barley Corns (bc.)	make	1 Inch, in.
12	Inches	-	1 Foot, ft.
$16\frac{1}{2}$	Feet	-	1 Rod, r.
40	Rods	-	1 Furlong, fur.
8	Furlongs	-	1 Mile, m.
$69\frac{1}{2}$	Statute Miles	-	1 Degree, Deg.

ALSO,

$7\frac{92}{100}$	Inches (in.)	make	1 Link, L.
25	Links	-	1 Rod, R.
4	Rods	-	1 Chain, C.
10	Chains	-	1 Furlong, F.
8	Furlongs	-	1 Mile, M.

ALSO,

4	Inches	make	1 Hand.
3	Feet	-	1 Yard.
$5\frac{1}{2}$	Yards	-	1 Rod, Pole, or Perch.
6	Feet	-	1 Fathom.
66	Feet	-	1 Gunter's Chain.
3	Miles	-	1 League.

NOTE 1.—The use of Long Measure, is to measure the distance of places, where length is considered, without regard to breadth.

NOTE 2.—The use of a League is to measure distances at Sea.
The use of a Hand, is to measure Horses.
The use of a Fathom, is to measure depths.
The Rod, Pole, and Perch, are equal.

NOTE 3.—The length of a Degree, is given in the first part of this Table, as is commonly practised: but geographers, reckon only 60 miles to a degree. A geographic mile, therefore, is longer than a statute mile.

QUESTIONS.

What are the denominations of long measure?
How many barley corns make an inch, &c.?
How many inches make a link, &c.?
What is the use of long measure? What of a league?
What is measured by the Hand? What is the use of a fathom?
What is the difference between the rod, pole, and perch?
Which is the longest, a statute, or geographic mile?

LAND, OR SQUARE MEASURE.

The denominations of Square Measure, are; Acres, Roods, Rods, Feet, and Inches.

ALSO,

Miles, Acres, Rods, Yards, and Feet.

144	Square	Inches	make	1	Square	Foot.
$272\frac{1}{4}$	-	Feet	-	1	-	Rod.
40	-	Rods	-	1	-	Rood.
4	-	Roods	-	1	-	Acre.

ALSO,

9	Square Feet	make	1	Square	Yard.
$30\frac{1}{4}$	-	Yards	-	1	-	Rod.
160	-	Rods	-	1	-	Acre.
640	-	Acres	-	1	-	Mile.

NOTE.—All surfaces that have length, and breadth, are measured by this measure.

QUESTIONS.

What are the denominations of Square Measure ?
How many square Inches, make a square Foot, &c. ?
How many square Feet, make a square Yard, &c. ?
What is the use of this measure ?

SOLID MEASURE.

The denominations of Solid Measure, are Tons, Feet, and Inches.

ALSO,

Cords, and Feet. Yards, and Feet.

1728 Solid Inches make 1 Solid Foot.
40 Feet of round, or 50 of hewn Timber } - 1 Ton.

ALSO,

27 Solid Feet make 1 Solid yard.
128 - Feet - 1 Cord of Wood ;
i. e. 8 in length, 4 in breadth, and 4 in heighth.

NOTE.—By Solid Measure, are measured all things that have length, breadth, and depth.

QUESTIONS.

What are the denominations of Solid Measure ?
How many solid Inches, make a solid Foot, &c. ?
How many solid Feet, make a solid Yard ?
How many solid Feet, make a Cord of Wood ?
hat is the use of this measure ?

WINE MEASURE.

The denominations of Wine Measure, are; Tuns, Pipes, Hogsheads, Gallons, Quarts, Pints, and Gills.

4 Gills (gl.)	make	1 Pint, pt.
2 Pints	-	1 Quart, qt.
4 Quarts	-	1 Gallon, gal.
63 Gallons	-	1 Hogshead, hhd.
2 Hogsheads	-	1 Pipe, P. or Butt, B.
2 Pipes or Bs.	-	1 Tun, T.

ALSO,

10 Gallons	make	1 Anchor, anc.
18 Gallons	-	1 Runlet, run.
$31\frac{1}{2}$ Gallons	-	1 Barrel, bar.
42 Gallons	-	1 Tierce, tier.

NOTE 1.—All Spirits, Wine, Oil, &c. are measured by Wine Measure.

NOTE 2.—The Wine Gallon contains 231 Cubic Inches. The subdivisions are in the same proportion.

QUESTIONS.

What are the denominations of Wine Measure?
How many gills make a pint, &c.?
What is measured by this measure?
What are the contents of a wine gallon?

ALE, OR BEER MEASURE.

The denominations of Ale, or Beer Measure, are;—Butts, Hogsheads, Gallons, Quarts, Pints, and Gills.

4 Gills (gl.)	make	1 Pint, pt.
2 Pints	-	1 Quart, qt.
4 Quarts	-	1 Gallon, gal.
54 Gallons	-	1 Hogshead, hhd.
2 Hogsheads	-	1 Butt, B.

ALSO,

9 Gallons	make	1 Firkin.
18 Gallons	-	1 Kilderkin.
36 Gallons	-	1 Barrel.
2 Barrels	-	1 Puncheon.
3 Barrels	-	1 Butt.

NOTE 1.—The Beer Gallon contains 282 Cubit Inches. The subdivisions are in the same proportion.

NOTE 2.—All kinds of Beer, Ale, Porter, &c. are measured by this measure.

QUESTIONS.

What are the denominations of Ale, or Beer Measure?
How many pints, make a quart, &c.?
What are the contents of the beer gallon?
What is the use of this measure?

DRY MEASURE.

The denominations of Dry Measure, are; Loads, Bushels, Pecks, Gallons, Quarts, Pints, and Gills.

4 Gills (gl.)	make	1 Pint, pt.
2 Pints	-	1 Quart, qt.
4 Quarts	-	1 Gallon, gal.
2 Gallons	-	1 Peck, pk.
4 Pecks	-	1 Bushel, bu.
40 Bushels	-	1 Load, Lo.

ALSO,

2 Quarts	make	1 Pottle.
4 Bushels	-	1 Strike.
8 Bushels	-	1 Coom.
32 Bushels	-	1 Chaldron.
40 Bushels	-	1 Wey.
80 Bushels	-	1 Last.

NOTE 1.—A Bushel, is $18\frac{1}{2}$ inches diameter, and 8 inches deep; and contains $2150\frac{2}{5}$ solid inches.

NOTE 2.—All kinds of Grain, Fruits, Salt, Coal, Oysters, &c. are measured by Dry Measure.

QUESTIONS.

What are the denominations of Dry Measure?
How many pints make a quart, &c.?
What are the contents of a bushel?
What is the use of this measure?

TIME.

The denominations of Time, are; Centuries, Years, Days, Hours, Minutes, and Seconds.

ALSO,

Years, Months, Weeks, and Days.

60	Seconds (sec.)	make	1 Minute, m.
60	Minutes	-	1 Hour, h.
24	Hours	-	1 Day, d.
$365\frac{1}{4}$	Days	-	1 Year, yr.
100	Years	-	1 Century, Cen.

ALSO,

7 Days (d.)	make	1 Week, w.
4 Weeks	-	1 Month, mo.
13 Months	-	1 Year, yr.

The year is also divided into 12 Calendar Months, viz.

Months.		Names.	Days.	Months.		Names.	Days.
1st	Month,	January,	31	7th	Month,	July,	31
2d	-	February,	28	8th	-	August,	31
3d	-	March,	31	9th	-	September,	30
4th	-	April,	30	10th	-	October,	31
5th	-	May,	31	11th	-	November,	30
6th	-	June,	30	12th	-	December,	31

The Week is divided into 7 Days, viz.

Days.		Names.	Days.		Names.
1st	Day,	Sunday.	5th	Day,	Thursday.
2d	-	Monday.	6th	-	Friday.
3d	-	Tuesday.	7th	-	Saturday.
4th	-	Wednesday.			

NOTE 1.—The names of the Months are derived from the Latin.

January, from Janus ; the God of Infants.
February, from Februa ; the mother of Mars.
March, from Mars ; the God of War : the first month of the Roman year.
April, from Aperio ; the opening of the year, or blossoms.
May, from Maia ; the mother of Mercury.
June, from Juno ; the wife of Jupiter.
July, from Julius Cesar ; the Roman emperor.
August, from Augustus Cesar ; the Roman emperor.
September, from Septem ; the 7th month of the Roman year.
October, from Octo ; the 8th month of the Roman year.
November, from Novem ; the 9th month of the Roman year.
December, from Decem ; the 10th month of the Roman year.

NOTE 2.—The names of the days of the Week, are derived from the names of the Saxon gods ; or objects of worship.

Sunday, from the Sun.
Monday, from the Moon.
Tuesday, from Tuisco ; a German hero.
Wednesday, from Woden ; the god of battle.
Thursday, from Thor ; the god of winds.
Friday, from Friga ; the goddess of peace.
Saturday, from Seator ; the god of freedom.

NOTE 3.—The days of the month may be easily told, after committing the following lines to memory:

Thirty days hath September, April, June, and November;
February hath twenty-eight alone, and all the rest have thirty-one.

OR,

The fourth, eleventh, ninth, and sixth,
Have thirty days to each affix'd;
And every other thirty-one,
Except the second month alone,
Which has but twenty-eight, in fine,
Till leap year, gives it twenty-nine.

NOTE 4.—A solar day, is that space of time which intervenes between the sun's departing from one meridian to the same again.

NOTE 5.—A solar year, according to the best computation, is 365 days, 5 hours, 48 minutes, and 57 seconds; almost 365¼ days.

NOTE 6.—When we can divide the year of our Lord by 4, without a remainder, it is then Bissextile, or Leap Year; in which February has 29 days, and the year 366 days.

QUESTIONS.

What are the denominations of time?
How many seconds make a minute, &c.?
Into how many calendar months is the year divided?
What are their names, and number of days in each month?
How many days are there in a week? What are their names?
From what are the names of the months derived?
From what are the names of the days of the week derived?
How may the days of the months, be most easily told?
What is a solar day? What is a solar year?
How is Bissextile, or Leap Year, found?
How many days has February, in Leap Year?
How many days are there in Leap Year?

MOTION.

The denominations of Motion, are; Signs, Degrees, Minutes, and Seconds.

60 Seconds (″)	make	1 Prime Minute, ′.
60 Minutes	-	1 Degree, °.
30 Degrees	-	1 Sign, S.
12 Signs, or 360 Degrees	-	The great circle of the Zodiac.

NOTE.—What is here meant by motion, is that of the heavenly bodies.

QUESTIONS.

What are the denominations of Motion ?
How many seconds make a prime minute, &c. ?
What is meant by motion ?

PARTICULARS.

12 Single things make 1 Dozen.
12 Dozen - 1 Gross.
12 Gross - 1 Great Gross.

ALSO;

20 Single things make 1 Score.
5 Score - 1 Hundred.

PAPER.

24 Sheets make 1 Quire.
20 Quire - 1 Ream.

NOTE 1.—Paper is called by the following names, viz.—Drawing, Writing, Printing, Sheathing, Wrapping, &c.

NOTE 2.—The sizes of Paper are designated by the following names, viz.—Pot, Fools-cap, Letter, Post-folio, Crown, Demy, Medium, Royal, Super-royal, Imperial, Elephant, &c.

PARCHMENT.

12 Skins make 1 Dozen.
5 Dozen - 1 Roll.

BOOKS.

When a sheet is folded into 2 Leaves, it is called Folio.
into 4 Leaves, - Quarto.
- 8 Leaves, - Octavo.
- 12 Leaves, - Duodecimo.

NOTE.—The smaller books are called 18's, 24's, 32's, 36's, &c. according to the number of leaves in a sheet.

QUESTIONS.

How many single things make a dozen, &c. ?
How many single things make a score, &c. ?
How many sheets make a quire, &c. ?
How many skins make a dozen, &c. ?
What is meant by folio, quarto, Octavo, &c. ?

REFINER'S WEIGHT.

24 Blanks make 1 Perrot.
20 Perrots - 1 Mite.
20 Mites - 1 Grain.

NOTE 1.—The fineness of Gold is tried by fire; if it lose nothing in the trial, it is said to be 24 Carets fine.

NOTE 2.—A Caret is the 24th part of any quantity or weight.

NOTE 3.—Silver, which abides the fire without loss, is said to be 12 ounces fine.

Names, Weights, and Value of several pieces of foreign gold, and silver coins; which pass current in the United States.

Names of Gold Coins.	Standard weights. *pwt.*	*gr.*	Value in Fed. Money. *Dols.*	*cts.*	*m.*
Johannas,	18	0	16	00	0
Half Johannas,	9	0	8	00	0
Doubloon,	16	21	14	93	3
Moidore,	6	18	6	00	0
English Guinea,	5	6	4	66	7
French Guinea,	5	5	4	60	0
Spanish Pistole,	4	6	3	77	3
French Pistole,	4	4	3	66	7
SILVER COINS.					
English or French crown,	18	0	1	10	0
Spanish Dollar,	17	6	1	00	0
English Shilling,	3	18		22	2
Pistareen,	3	11		20	0

TABLE,

Shewing how to read sums in Federal Money.

Tens of thou. of dollars.	Thousands of dollars.	Hundreds of dollars.	Tens of dolls.	Dollars.	Tens of cts.	Cents.	Mills.		
							4	=	4 mills.
						6 .	7	=	6 cents, 7 mills.
					8	0 .	9	=	80 cents, 9 mills.
				1 .	2	8 .	0	=	1 dollar, 28 cts.
			9	6 .	4	7 .	4	=	96 dol. 47 cts. 4 m.
		6	3	2 .	0	0 .	0	=	632 dollars
	1	4	0	7 .	0	9 .	1	=	1407 dol. 9 cts. 1 m.
3	0	4	6	0 .	1	0 .	7	=	30460 dol. 10 cts. 7 m.

FEDERAL MONEY.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 10, because 10 dollars make 1 eagle.	Carry by 10, because 10 dimes make 1 dollar.	Carry by 10, because 10 cents make 1 dime.	Carry by 10, because 10 mills make 1 cent.
	E.	D.	d.	c.	m.
	69	8	7	6	5
	3	4	5	6	7
	91	0	2	0	3
	66	6	6	6	6
Sum.	231	0	2	0	1
Proof,	231	0	2	0	1

by adding downwards.

2.

Carry by 10, as in whole numbers.	Carry by 10, because 10 dollars make 1 eagle.	Carry by 10, because 10 dimes make 1 dollar.	Carry by 10, because 10 cents make 1 dime.	Carry by 10, because 10 mills make 1 cent.
E.	D.	d.	c.	m.
47	6	5	4	3
34	8	2	7	1
29	3	6	8	2
6	5	0	2	4

NOTE.—Carrying the number of tens from one column to another: will give the correct answer, where dollars, cents and mills, only, are mentioned.

3.

$	cts.	m.
1276	19	6
742	96	0
425	14	1
1734	5	7
97	76	3
9	10	0

4.

$	cts.	m.
1500	15	9
1000	17	7
200	16	5
100	11	6
47	98	0
351	30	9

5.

$	cts.
9	02 $\frac{1}{10}$
6	93 $\frac{3}{10}$
	75
3	09
7	60 $\frac{6}{10}$
8	49

NOTE.—Where the numbers are here set down fractionwise after cents, the upper numbers are so many mills.

6.	7.	8.
$34.47	$86.79 $\frac{3}{10}$	$674.49 $\frac{1}{10}$
29.04	47.30 $\frac{6}{10}$	300.87 $\frac{7}{10}$
80.60	10.01	98.16 $\frac{2}{10}$
4.37	8.60 $\frac{4}{10}$	100.00
	19.03 $\frac{8}{10}$	9.06 $\frac{1}{10}$
Sum.	5.49	47.00 $\frac{2}{10}$
Proof.		

9.—Add the following sums together; $467 . 19+ $19 . 01 $\frac{1}{10}$+$47 . 00 $\frac{6}{10}$, and $100 : 10 $\frac{1}{10}$.

Amount, $633 . 30 $\frac{8}{10}$.

10.—What is the amount of one hundred and ten dollars, forty-nine cents, four mills.+Ninety seven dollars, three mills.+and two hundred nine dollars, fifty cents; added together? *Amount*, $416 . 99 . 7m.

ENGLISH MONEY.

EXAMPLES.

1.

	£	s.	d.	qrs.
	462	14	11	2
	41	19	4	3
	72	17	10	2
	320	18	6	2
Amount.	£898	10	9	1

NOTE 1.—9; Being the amount of the farthings, I divide them by 4; the number of farthings in a penny, thus— 4) 9 (2 d. the 2 pence I carry to the column of pence, and 8 the one farthing left I set down under the column — of farthings.

1 qrs.

33; Being the amount of the pence, I divide them by 12; the number of pence in a shilling, thus— 12)33(2s. the 2 shillings I carry to the column of shillings, 24 and the 9 pence left, I set down under the column — of pence.

9d.

70 : Being the amount of the shillings, I divide them by 20; the number of shillings in a pound, thus— 20)70(3£. the 3 pounds, I carry to the first column of pounds, 60 and the 10 shillings left, I set down under the column — of shillings.
10s.

898 : Being the amount of the pounds, I set them down under the columns of pounds; and find the whole amount, or answer to be; 898 pounds, 10 shillings, 9 pence, and 1 farthing.

NOTE 2.—Proceed as above, to find the amount of any sums in Compound Addition; whether it be Money, Weight, or Measure.

2.

	Carry by 10, as in whole numbers.	Carry by 20, because 20 shillings make 1 pound.	Carry by 12, because 12 pence make 1 shilling.	Carry by 4, because 4 farthings make 1 penny.
	£.	s.	d.	qrs.
	47	16	10	2
	64	9	8	0
	9	15	11	1
	55	8	6	0
Sum.	177	10	11	3
	129	14	1	1
Proof,	177	10	11	3

3.

Carry by 10, as in whole numbers.	Carry by 20, because 20 shillings make 1 pound.	Carry by 12, because 12 pence make 1 shilling.	Carry by 4, because 4 farthings make 1 penny.
£.	s.	d.	qrs.
100	14	9	3
96	5	4	1
3	19	6	0
85	3	10	2

by cutting off the upper row of figures, &c.

4.

£.	s.	d.	qrs.
456	19	8	1
85	4	10	2
964	3	2	0
55	15	5	0

5.

£.	s.	d.	qrs.
99	18	7	3
67	9	8	1
10	14	10	0
79	6	1	0

6.

£.	s.	d.	qrs.
500	17	9	0
175	6	10	1
1	19	4	2
100	14	11	3

7.

£.	s.	d.	qrs.
49	14	4	1
2	4	6	1
60	10	1	2
14	1	2	3
15	2	3	0
16	3	4	1

8.

£.	s.	d.
3067	14	6 $\frac{2}{4}$
916	4	10 $\frac{3}{4}$
73	18	4 $\frac{1}{4}$
8	7	11 $\frac{2}{4}$

9.

£.	s.	d.
470	19	11 $\frac{3}{4}$
317	16	10 $\frac{1}{4}$
50	4	5 $\frac{2}{4}$
410	2	6
102	17	4
70	3	7 $\frac{1}{4}$

NOTE.—Where the numbers are here set down fractionwise after pence, the upper numbers are so many farthings.

10.

£.	s.	d.
1420	14	7 $\frac{1}{4}$
140	17	4
17	19	2
170	7	1 $\frac{1}{4}$

11.

£.	s.	d.
107	18	4 $\frac{2}{4}$
50	12	2 $\frac{1}{4}$
14	14	11 $\frac{1}{4}$
16	7	1 $\frac{3}{4}$

12. Add the following sums together: £19 . 6 . 7¼.+ £100,+£79 . 16 . 4¾,+£0 . 15 . 9, and+£201 . 17 . 6¾.
Amount, £401 . 16 . 3¾.

13. What is the amount of £39 . 6 . 0¼,+£27 . 15, +£106 . 9 . 4½.+£75 . 16, and+£10 . 14: added together.
Ans. £260 . 0 . 4¾.

14. What is the sum of sixty-six pounds, fifteen shillings, and nine pence.+one hundred and forty pounds,

+eighteen pounds, and one farthing,+and ninety-three pounds, twelve shillings, and three farthings?

Ans. £318 . 7 . 10.

15. Add one hundred pounds, =
Eighty pounds and three pence, =
Seventeen shillings and one farthing together. } =

Sum total, £180 . 17 . 3¼.

TROY WEIGHT.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 12, because 12 oz. make 1 lb.	Carry by 20, because 20 pwts. make 1 oz.	Carry by 24, because 24 grs. make 1 pwt.
	lb.	oz.	pwt.	gr.
	267	11	19	23
	180	9	4	16
	40	4	9	10
	444	6	17	4
Sum.	933	8	11	5
Proof.	933	8	11	5

2.

Carry by 10, as in whole numbers.	Carry by 12, because 12 oz. make 1 lb.	Carry by 20, because 20 pwts. make 1 oz.	Carry by 24, because 24 grs. make 1 pwt.
lb.	oz.	pwt.	gr.
49	8	7	4
50	11	4	7
1	10	19	20
70	1	0	1

3.

lb.	oz.	pwt.	grs.
42	9	14	16
199	2	17	15
14	11	19	21
16	10	18	19

4.

lb.	oz.	pwt.	grs.
20	10	5	2
2	4	11	6
	9	7	6
16	8	4	17
24	7	19	2
41	9	10	11

5. Add the following sums together; 46 lbs. 9 oz. 15 pwt. 16 gr.+87 lb. 10 oz. 6 pwt. 14 gr.+100 lb. 10 oz. 10 pwt. 10 gr.+and 56 lb. 0 oz. 3 pwt. 6 gr.

Total weight, 291 lb. 6 oz. 15 pwt. 22 gr.

6. What is the weight of forty-six pounds, eight ounces, thirteen penny-weights, fourteen grains,+Ninety-seven pounds, three ounces,+and one hundred pounds, five ounces, ten penny-weights, thirteen grains; added together. *Ans.* lb. 244 . 5 . 4 . 3 gr.

AVOIRDUPOIS WEIGHT.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 20, because 20 hundred make 1 ton.	Carry by 4, because 4 quarters make 1 cwt.	Carry by 28, because 28 lbs. make ¼ of a cwt.	Carry by 16, because 16 ounces make 1 pound.	Carry by 16, because 16 drams make 1 ounce.
	T.	cwt.	qr.	lb.	oz.	dr.
	46	14	1	22	14	15
	9	0	3	16	9	6
	75	16	2	0	1	0
	8	1	0	4	12	13
Sum.	139	12	3	16	6	2
Proof.	139	12	3	16	6	2

2.

Carry by 10, as in whole numbers.	Carry by 4, because 4 quarters make 1 cwt.	Carry by 28, because 28 lbs. make ¼ of a cwt.
Cwt.	qr.	lb.
19	1	14
8	0	10
11	2	7
7	1	18

3.

lb.	oz.	dr.
16	14	10
17	15	14
18	12	11
19	1	2

4.

T.	cwt.	qr.	lb.	oz.	dr.
91	19	2	27	15	15
17	16	3	4	5	6
19	11	1	19	10	7
20	7	2	14	18	4
99	17	3	10	0	8
49	14	0	9	13	12

5. Add the following sums together; 29 T. 16 cwt. 1 qr. 14 lb. 12 oz. 9 dr.+18 cwt. 3 qrs. 21 lb.+50 T. 3 qrs. 4 oz.+and 2 T. 1 qr. 14 dr.

Whole Weight, 82 T. 16 cwt. 1 qr. 8 lb. 1 oz. 7 dr.

6. What is the weight of Thirty-nine tons, ten hundred, one quarter, twenty-seven pounds, fifteen ounces, twelve drams,+seventeen hundred, six pounds+twelve hundred, three quarters,+and two quarters, eight pounds, nine drams, added together?

Ans. T. 41 . 0 . 3 . 14 . 0 . 5 dr.

APOTHECARIES WEIGHT.

EXAMPLES.

1.

	Carry by 10, as in whole numbers. ℔	Carry by 12, because 12 ounces make 1 pound. ℥	Carry by 8, because 8 drams make 1 ounce. ʒ	Carry by 3, because 3 scruples make 1 dram. ℈	Carry by 20, because 20 grains make 1 scruple. gr.
	12	6	4	1	19
	6	10	7	2	4
	26	9	1	0	17
	3	6	5	1	9
Sum.	49	9	3	0	9
	37	2	6	1	10.
Proof.	49	9	3	0	9

2.

	Carry by 10, as in whole numbers. ℔	Carry by 12, because 12 ounces make 1 pound. ℥	Carry by 8, because 8 drams make 1 ounce. ʒ	Carry by 3, because 3 scruples make 1 dram. ℈	Carry by 20, because 20 grains make 1 scruple. gr.
	49	4	3	2	10
	19	7	0	1	9
	5	0	5	0	16
	31	3	7	1	7
Sum.					
Proof.					

3.

℔	℥	ʒ	℈	gr.
71	11	6	2	20
17	10	4	1	19
16	7	7	0	7
91	9	2	1	6

4.

℔	℥	ʒ	℈	gr.
10	4	7	1	19
14	6	4	2	16
16	10	6	0	4
9	9	1	0	7
18	1	0	2	18
7	5	1	0	10

5. Add the following sums together; 19 ℔, 10 ℥, 4 ʒ, 2 ℈ 16 gr.+9 ℥, 7 ʒ, 17 gr.+and 3 ℔, 6 ℥, 5 ʒ, 1 ℈ 18 gr.
Weight, 24 ℔, 3 ℥, 1 ʒ, 2 ℈, 11 gr.

6. What is the weight of twenty-six pounds, ten ounces, seven drams, one scruple, fifteen grains+Four pounds, nineteen grains+Six ounces, two scruples, fourteen grains+and ten pounds, five drams, two grains added together. *Ans.* ℔ 41 . 5 . 5 . 2 . 10 gr.

CLOTH MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers. Yd.	Carry by 4, because 4 qrs. make 1 yd. qr.	Carry by 4, because 4 ns. make ¼ of a yd. n.	Carry by 2¼, because 2¼ in. make 1 nail. in.
	49	2	2	2
	16	3	3	1
	57	2	2	0
	42	3	3	2
Sum.	167	1	0	0½
	117	2	1	0¾
Proof.	167	1	0	0½

2.

Carry by 10, as in whole numbers. Yd.	Carry by 4, because 4 qrs. make 1 yd. qr.	Carry by 4, because 4 ns. make ¼ of a yd. n.
76	2	3
3	3	1
91	3	2
6	2	3

3.

E.Fl.	qr.	n.
16	2	2
14	1	1
59	0	3
17	1	0

4.

E.E.	qr.	n.
20	4	1
16	3	0
49	2	3
6	2	3
61	4	3
91	3	2

5.

E.Fr.	qr.	n.
70	5	3
19	4	2
39	3	1
6	2	1
19	5	2
49	3	3

6. Add the following sums together; 16 yd. 3 qr. 2 n. +9 yd. 1 n.+27 yd. 1 qr.+and 3 qr. 3 n.

Whole length, 5 4 yds. 0 qr. 2 n.

7. What is the length of fifty-six yards, one quarter, two nails,+seven yards, one nail,+thirty yards, three quarters,+and six yards, two nails, added together?

Ans. 1 0 0 yds. 1 qr. 1 n.

LONG MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 69½, because 69½ mi. make 1 deg.	Carry by 8, because 8 fur. make 1 mile.	Carry by 40, because 40 poles make 1 fur.	Carry by 16½, because 16½ ft. make 1 pole.	Carry by 12, because 12 in. make 1 foot.	Carry by 3, because 3 bc. make 1 inch.
	Deg.	mi.	fur.	pol.	ft.	in.	bc.
	97	18	0	7	4	5	0
	8	55	6	19	7	4	2
	74	13	5	6	10	2	1
	35	16	2	12	9	8	0
Sum,	215	33½	6	5	14½	8	0
	118	15½	5	38	10½	3	0
Proof,	215	33½	6	5	14½	8	0
True Sum,	215	34	2	5	15	2	0

2.

Carry by 10, as in whole numbers.	Carry by 5½, because 5½ yds. make 1 pole.	Carry by 3, because 3 feet make 1 yd.	Carry by 12, because 12 in. make 1 foot.
Pol.	yd.	ft.	in.
50	5	2	10
7	4	1	9
94	2	2	11
5	0	1	7

NOTE 1.—To carry by 16½, 69½, or where there is a fractional part of an integer; I multiply the upper number of the fraction in the divisor by the quotient figure; then divide the product by the lower number of the fraction, and carry the quotient to the product of the whole number: then subtract the upper number of the remaining fraction, (if any,) from the lower, and set down the remainder, to the right of the whole numbers: then carry one to the whole numbers for the fraction borrowed.

NOTE 2.—To find the true answer to the foregoing sum; I say, the ½ foot left, is 6 inches, which added to the 8 inches, makes 14; this sum I divide by 12, the number of inches in a foot—the remainder 2, I set down under the inches; and the quotient 1, I carry to the 14, which makes 15 feet.

I then say, the ½ mile left is 4 furlongs, which added to the 6 furlongs, makes 10; this sum I divide by 8, the number of furlongs in a mile—the remainder 2, I set down under the furlongs, and the quotient 1, I carry to the 33, which makes 34 miles.

The true answer therefore, to the foregoing example in whole numbers, is 215 deg. 34 m. 2 fur. 5 pol. 15 ft. 2 in. 0 bc.

3.

Pol.	yd.	ft.	in.
30	5	1	6
16	2	2	9
14	3	0	7
17	4	1	8

4.

Deg.	mi.	fur.	pol.	ft.	in.	bc.
94	57	7	39	14	11	2
16	46	4	20	12	9	1
70	17	6	14	10	7	0
19	4	3	7	9	4	0
60	7	2	4	7	3	2
10	6	7	6	4	1	1

5. Add the following sums together; 64 Deg. 38 mi. 4 fur. 26 pol. 15 ft. 10 in. 2 bc.+49 mi. 7 fur. 38 pol. 12 ft. 9 in. 1 bc.+6 fur. 20 pol.+and 9 mi. 3 fur. 29 pol. 9 ft. 8 in.

Total Length, 65 Deg. 28½ mi. 6 fur. 35 pol. 5 ft. 4 in 0 bc.

6. What is the length of forty-three degrees, thirty miles, four furlongs+sixteen miles, five furlongs, twenty poles, twelve feet,+and nine degrees, six miles, seven furlongs, thirty poles, twelve feet, ten inches, two barley corns: added together?

Ans. 52 Deg, 54 m. 1 fur. 11 pol. 7½ ft. 10 in. 2 bc.

LAND, OR SQUARE MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers. Acres.	Carry by 4, because 4 sq.roods make 1 sq.acre. roods.	Carry by 40, because 40 sq.poles make 1 sq.rood. pol.	Carry by $272\frac{1}{4}$, because $272\frac{1}{4}$ sq.ft.make 1 sq.pol. feet.	Carry by 144, because 144 sq.in.make 1 sq.foot. in.
	196	3	37	250	139
	47	1	16	76	94
	210	0	8	162	100
	4	2	27	18	41
Sum.	459	0	9	$235\frac{3}{4}$	86
	262	0	11	257	91
Pr'f.	459	0	9	$235\frac{3}{4}$	86

2.

Carry by 10, as in whole numbers. yd.	Carry by 9, because 9 sq. ft. make 1 sq. yd. ft.	Carry by 144, because 144 sq.in.make 1 sq.foot. in.
18	7	140
6	2	19
17	4	97
3	6	42

3.

Acres.	roods.	poles.
76	1	10
162	2	9
17	1	7
4	0	6

4.

Acres.	roods.	poles.	feet.	in.
117	1	39	210	141
8	1	16	98	99
14	0	17	90	6
200	2	4	19	14
97	1	19	14	10
5	0	5	16	5

5. Add the following sums together; 314 acres, 2 roods, 39 poles, 200 feet, 136 in.+16 A. 1 r. 20 p. 10 ft.+3 r. 36 p.+and 4 A. 1 r. 16 p.

Answer. 336 A. 1 r. 31 p. 210 ft. 136 in.

6. What are the square contents of twenty acres, three roods, fifteen poles, two hundred and fifty feet, one hun-

dred and sixteen inches+nineteen acres, one rood, thirty-nine poles+two roods, ten poles, sixty feet+and five acres, six poles, fifty inches?

Answer. Acres, 45 . 3 . 31 . $38\frac{3}{4}$. 22 in.

SOLID MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers. Ton.	Carry by 40, because 40 solid feet make 1 ton. feet.	Carry by 1728, because 1728 solid inches, make 1 solid foot. in.
	49	19	1666
	19	10	1001
	16	36	109
	4	17	1727
Sum.	90	4	1047
	40	24	1109
Pr'f.	90	4	1047

2.

Carry by 10, as in whole numbers. Yds.	Carry by 27, because 27 solid ft. make 1 solid yd. feet.	Carry by 1728, because 1728 solid inches, make 1 solid foot. in.
*71	9	1444
14	19	999
8	6	1714
42	26	1000

NOTE.—Call 40 feet a ton, where hewn timber is not mentioned.

3.

Cord.	feet.	in.
34	120	1416
12	17	97
7	127	161
20	16	41

4.

Ton.	feet.	in.
44	39	1677
19	20	21
55	16	1719
18	17	400
66	14	101
17	10	1601

5. Add the following sums together; 45 Tons, 3 feet. 1718 inches+31 T. 16 ft. 416 in.+64 T. 19 ft. 500 in.+ and 75 T. 24 ft. 900 in. *Ans.* 216 T. 27 ft. 78 in.

6. What are the solid contents of sixty-four tons, thirty-three feet, eight hundred inches+nine tons, twelve hundred inches+twenty-five feet, seven hundred inches +and ninety-five tons, thirty-one feet, one thousand five hundred inches? *Ans.* 170 T. 11 ft. 744 in.

WINE MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 4, because 4 hhds. make 1 tun.	Carry by 63, because 63 gals. make 1 hhd.	Carry by 4, because 4 qts. make 1 gallon.	Carry by 2, because 2 pints make 1 quart.	Carry by 4, because 4 gills make 1 pint.
	Tun.	hhd.	gal.	qt.	pt.	gl.
	67	2	60	3	1	3
	19	3	10	2	0	1
	47	1	20	1	1	1
	90	2	10	3	0	2
Sum,	225.	1	39	2	1	3
	157	2	41	3	0	0
Pr'f.	225	1	39	2	1	3

2.

Carry by 10, as in whole numbers.	Carry by 63, because 63 gals. make 1 hhd.	Carry by 4, because 4 qts. make 1 gallon.	Carry by 2, because 2 pts. make 1 qt.
Hhd.	gal.	qt.	pt.
60	51	1	1
14	41	2	1
16	14	3	0
17	15	0	1

3.

Bar.	gal.	qt.
49	29	2
16	14	1
31	9	0
7	5	1

4.

Tun.	bt.	hhd.	gal.	qt.	pt.	gl.
57	1	0	46	3	1	3
9	0	1	54	2	0	1
46	0	1	8	1	1	2
91	1	0	8	1	0	1
6	1	0	30	0	1	0
18	0	1	24	1	1	3

5. Add the following sums together; 49 Tuns, 3 hhds. 49 gal. 3 qts. 1 pt. 2 gls.+19 T. 2 hhds. 37 gal. 1 qt.+1 hhd. 51 gals.+and 74 T. 3 hhds, 19 gals. 2 qts. 1 pt. 2 gls.

Ans. 144 T. 3 hhds. 31 gals. 3 qts. 1 pt. 0 gl.

6. What are the contents of twenty-four tuns, one hogshead, thirty-four gallons, two quarts, 1 pint, two gills +Two hogsheads, fifty-three gallons+Three tuns, twenty-one gallons, one pint+and fourteen tuns, three hogsheads, nineteen gallons, three quarts, one pint, two gills?

Ans. Tuns. 43 . 0 . 2 . 3 . 0 . 0 gl.

ALE, OR BEER MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 2, because 2 hhds. make 1 butt.	Carry by 54, because 54 gals. make 1 hhd.	Carry by 4, because 4 qts. make 1 gal.	Carry by 2, because 2 pts. make 1 qt,	Carry by 4, because 4 gills make 1 pt.
	Butt.	hhd.	gal.	qt.	pt.	gl.
	97	1	51	2	1	3
	64	0	37	1	0	2
	8	1	20	2	1	1
	55	0	9	0	0	0
Sum,	226	0	10	2	1	2
Proof,	226	0	10	2	1	2

2.

Carry by 10, as in whole numbers.	Carry by 36, because 36 gals. make 1 bar.	Carry by 4, because 4 qts. make 1 gal.
Bar.	gal.	qt.
17	20	2
64	34	3
9	16	0
14	9	1

3.

Hhd.	gal.	qt.
13	40	1
14	50	0
17	10	1
10	17	3

4.

Butt.	hhd.	gal.	qt.	pt.	gl.
71	1	53	2	1	3
41	1	43	3	0	2
16	0	33	3	0	1
19	1	43	1	1	0
91	0	16	2	0	1
17	1	10	2	1	0

5. Add the following sums together; 24 Butts, 1 hhd. 48 gals. 3 qts. 1 pt. 2 gls.+19 Butts, 9 gals. 2 qts.+50 gals. 2 qts. 1 pt.+and 56 Butts, 52 gals. 1 pt. 2 gls.

Total Sum, 100 B. 1 hhd. 53 gal. 1 qt. 0 pt. 0 gl.

6. What are the contents of forty-six butts, one gallon, one pint+one hogshead, forty-four gallons, two quarts, one pint, two gills+ten butts, one hogshead+and one butt, one hogshead, one gallon, one quart, one pint, one gill? *Ans.* Butts. 58 . 1 . 47 . 0 . 1 . 3 gls.

DRY MEASURE.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 4, because 4 pecks make 1 bu.	Carry by 2, because 2 galls. make 1 pk.	Carry by 4, because 4 quarts make 1 gal.	Carry by 2, because 2 pints make 1 qt.	Carry by 4, because 4 gills make 1 pint.
	Bu.	pk.	gal.	qt.	pt.	gl.
	197	3	1	3	1	0
	46	0	0	2	0	1
	8	2	1	0	1	2
	216	1	0	1	0	3
Sum,	468	3	1	3	1	2
Proof,	468	3	1	3	1	2

2.

Carry by 10, as in whole numbers.	Carry by 4, because 4 pecks make 1 bu.	Carry by 8, because 8 quarts make 1 pk.	Carry by 2, because 2 pints make 1 qt.
Bu.	pk.	qt.	pt.
34	3	7	1
66	1	3	0
77	2	5	1
6	0	0	3

3.

Pk.	gal.	qt.	pt.
10	1	3	1
17	0	2	0
14	1	0	0
7	1	1	1

4.

Bu.	pk.	gal.	qt.	pt.	gl.
110	3	0	2	0	1
9	2	1	1	1	0
2	1	0	0	0	1
117	0	1	3	1	3
4	2	1	2	1	2
19	1	1	1	1	1

5. Add the following sums together; 96 Bu. 3 pk. 1 gal. 2 qt. 1 pt. 1 gl.+46 Bu. 1 gal. 1 pt. 2 gl.+3 pk. 1 gal. 3 gl.+and 23 Bu. 3 pk. 1 gal. 1 qt. 1 pt. 2 gl.

Sum, 167 Bu. 3 pk. 1 gal. 1 qt. 1 pt. 0 gl.

6. What are the contents of Nineteen bushels, two pecks, one gallon, two quarts, one pint, one gill,+Fifty bushels, three pecks,+Sixty-seven bushels, three quarts, one gill,+and ten bushels, one peck, one gallon, two quarts, one pint, two gills?

Ans. Bu. 148 . 0 . 0 . 0 . 1 . 0 gl.

TIME.

EXAMPLES.

1.

	Carry by 10, as in whole numbers.	Carry by 13, because 13 mo. make 1 yr.	Carry by 4, because 4 weeks make 1 mo.	Carry by 7, because 7 days make 1 week.	Carry by 24, because 24 hours make 1 d.	Carry by 60, because 60 minutes make 1 h.	Carry by 60, because 60 sec. make 1 m.
	Yr.	mo.	w.	d.	h.	m.	s.
	49	12	3	6	23	59	40
	6	8	1	4	19	4	7
	18	10	2	5	7	5	29
	4	7	0	0	14	35	5
Sum,	80	0	0	3	16	44	21
	30	0	0	3	16	44	41
Proof,	80	0	0	3	16	44	21

2.

Carry by 10, as in whole numbers.	Carry by 13, because 13 mo. make 1 yr.	Carry by 28, because 28 days make 1 mo.
Yr.	m.	d.
7	10	27
6	8	4
13	5	16
19	11	7

NOTE.—From days to years, carry here by 365¼; and from days to months, by 28.

3.			4.				
Yr.	da.	h.	Yr.	da.	h.	m.	s.
467	360	23	249	360	23	50	59
41	51	21	110	130	9	40	49
47	230	20	7	9	11	13	15
301	41	19	119	119	10	14	16
			9	8	7	6	5
			117	110	4	59	6

5. Add the following sums together; 49 yr. 320 da. 14 h. 49 m 37 s.+360 da. 19 h. 8 m. 45 s.+76 yr. 200 d. +and 16 yr. 150 d. 20 h. 54 m. 45 s.

Sum total, 143 yr. 301½ da. 6 h. 53 m. 7 s.

6. What is the whole time of twenty-four years, sixty-seven days, nineteen hours, forty-three minutes, thirty-four seconds,+three hundred days, ten hours+two hundred and ninety days, fifty minutes,+and eighty-six years, three hundred and twenty days, fifty-one minutes?

Ans. Yr. 112 . 247½ . 7 · 24 . 34 sec.

MOTION.

EXAMPLES.

	1.				2.			
	Carry by				Carry by			
Reject the 12s*.	30.	60.	60.		10.	60.	60.	
	S.	°	′	″	S.	°	′	
	11	26	48	53	29	39	46	
	10	19	20	41	19	16	34	
	7	6	8	5	8	27	6	
	9	20	14	34	16	42	19	
Sum.	3	12	32	13				
	3	15	43	20				
Proof.	3	12	32	13				

* NOTE.—In adding signs, reject all the twelves, and set down only the excess; because 12 signs complete the great circle of the Zodiac.

3.

S.	°	′
10	8	7
9	26	51
8	10	10
7	14	16

4.

S.	°	′	″
11	17	6	59
10	9	59	40
9	11	50	10
8	16	17	17
7	10	14	14
6	3	4	5

5. Add the following sums together; 9 S. 20°, 34′, 37″,+17°, 36′, 44″,+7 S. 28°, 39′, 14″,+and 8 S. 24°, 38′, 55″, *Sum*, 3 S. 1°, 29′, 30″.

6. What is the extent of five signs, twenty degrees, thirty minutes forty seconds+seven signs, fifty-four minutes+eight signs, nine degrees, fifty-four seconds+and twenty-nine degrees, sixteen minutes, forty-five seconds? *Ans.* 9 S. 29°, 42′, 19″.

PARTICULARS.

EXAMPLES.

Carry by

	10.	12.	12.	12.
	Great Gross.	Gross.	Doz.	Single things.
	467	10	9	8
	612	9	11	10
	421	4	1	2
Sum.	1502	0	10	8
Pr'f.	1502	0	10	8

Carry by

10.	12.	12.	12.
Great Gross.	Gross.	Doz.	Single things.
26	11	10	9
4	9	1	0
15	3	6	8

Carry by

10.	5.	20.
Hund.	Score.	S.Things.
146	3	15
90	4	19
67	0	10
10	2	1

Carry by

10.	20.	24.
Reams.	Quires.	Sheets.
76	19	23
16	8	13
4	0	0
90	11	8

COMPOUND SUBTRACTION.

Compound Subtraction, teaches to find the difference between any two sums, of different denominations.

TERMS.

Minuend, is the greater number.
Subtrahend, is the less number.
Remainder, is the number left after subtracting.

RULE.

Place those numbers under each other which are of the same denomination, the subtrahend under the minuend.

Begin with the right hand, or lowest denomination; subtract the subtrahend from the minuend, and set down the remainder.

If the lower number exceeds the one above it, borrow from the number it takes of that denomination to make one of the next greater.

Add the remainder and upper number together, place that sum underneath the figures subtracted, and carry one to the next superior denomination in the subtrahend for that which was borrowed, and so on to the highest and last denomination; where work as in Simple Subtraction.

PROOF.

Subtract the remainder from the minuend, and if the work is right, the second remainder will be equal to the subtrahend.

Or, add the remainder and subtrahend together; whose sum, if the work is right, will be equal to the minuend.

QUESTIONS.

What does Compound Subtraction teach? Which number is the minuend? Which number is the Subtrahend? Which number is the remainder?

How are the numbers to be placed? Where do we begin to subtract? How do we proceed when the lower number is greater than the upper? What is then to be done? How is Compound Subtraction proved?

FEDERAL MONEY.

Note.—Borrow from 10, the same number that was carried by in Addition of Federal Money.

EXAMPLES.

Subtract the subtrahend from the minuend of the following sums, and tell their remainders.

1.

	E.	D.	d.	c.	m.
From,	6	4	9	3	7
Take,	1	3	7	0	1
Rem.	5	1	2	3	6
Proof,	1	3	7	0	1

2.

	E.	D.	d.	c.	m.
Min.	9	0	6	7	4
Sub.	4	0	3	1	2
Rem.					
Proof.					

by subtracting the remainder from the minuend, which second remainder is equal to the subtrahend.

	3.	4.	5.
	D. c.		D. c. m.
Min.	49 36	$216.90	34 06 4
Sub.	9 67	71.37	16 90 0
Rem.	39 69		

	6.	7.	8.
From,	$100.00	$100.00	$50.00
Take,	99.99$\frac{9}{10}$	$\frac{1}{10}$	50 cts.
Rem.	$ 00.00$\frac{1}{10}$	$	$

9.		10.
$671.10.4	Borrowed,	$160.19.4
16.19.4	Paid,	93.50
$	Due,	$ 66.69.4

11.

Borrowed of A.	$1 0 0 . 0 0 . 0	
Paid at one time,	5 0	How much is now due him?
At another time.	2 1 . 5 0	
Paid in all,	$ 7 1 . 5 0 . 0	
Ans.	$ 2 8 . 5 0 . 0	Remains due to A.

NOTE.—Here I first add together the several payments; then subtract the amount paid, from the sum borrowed, to find what is due.

12.

Lent to B.	$1 0 9 6 . 1 3 $\frac{7}{10}$	
Received at one time,	1 5 0	How much does he still owe me?
At another,	3 6 . 9 7 $\frac{2}{10}$	
At another time,	5 0 0	
Received in all,	$	
Ans.	$ 4 0 9 . 1 6 $\frac{5}{10}$	Remains due.

13.

C. gave me his note for	$1 0 0 0	
Paid me at one time,	1 5 0	How much remains due on the Note?
At another,	9 9 . 9 9 $\frac{9}{10}$	
At another,	2 5 0	
At another time,	3 0 0	
Received in all,	$	
Remains due on the note.	$	Ans.

	From.		Take.		Remainder.
14.	$1496 . 39$\frac{3}{10}$	—	$967 . 47$\frac{7}{10}$	=	$528 . 91$\frac{6}{10}$
15.	101 . 01	—	1 . 01	=	
16.	1000	—	999	=	
17.	1111 . 11$\frac{1}{10}$	—	111 . 11$\frac{2}{10}$	=	
18.	100	—	1	=	

19. Subtract one hundred and sixty-seven dollars, twenty-five cents, and three mills—from five hundred dollars. *Remainder* $332 . 74 . 7

20. From seven thousand and seven dollars—take one thousand two hundred and forty dollars, fifteen cents, and four mills. *Remainder*, $5766 . 84 . 6m.

ENGLISH MONEY.

EXAMPLES.

NOTE.—Borrow from 4, in farthings ; 12, in pence ; 20 in shillings, and 10 in pounds, the same numbers that were carried by, in addition of English money.

1.

	£.	s.	d.	qrs.
From	49	14	6	3
Take	39	16	7	0
Rem £	9	17	11	3
Proof £	49	14	6	3

NOTE 1.—In this example, I begin with the farthings, and say ; 0 from 3, leaves 3, which I set down under the farthings : then 7 from 6, I cannot ; but 7 from 12, leaves 5, which added to the 6 above, makes 11 pence ; which I set down under the pence—I then carry one to the 16 shillings, which makes 17 ; then say, 17 from 20 leaves 3 ; which added to the 14 above, makes 17 shillings, which I set down under the shillings ; I then carry one to the right hand figure of the pounds, and proceed with them as in simple subtraction.

NOTE 2.—The work is proved, by adding the remainder and subtrahend together, which sum is equal to the minuend.

2.

	£	s.	d.	qrs.
Min.	467	13	6	1
Sub.	418	9	6	2
Rem. £				

3.

£.	s.	d.
749	10	9¼
139	16	4

4.

	£.	s.	d.	qrs.
From	100	0	0	0
Take				1
Rem. £	99	19	11	3
Proof £	100	0	0	0

5.

£	s.	d.
100	0	0
99	19	11¾

6.

	£.	s.	d.
Min.	999	19	9
Sub.	111	11	11
Rem. £			

7.

£.	s.	d.
100	10	10$\frac{1}{4}$
11	11	11$\frac{1}{4}$

8.

	£.	s.	d.	
Borrowed of A.	416	11	4$\frac{3}{4}$	How much is now due
Paid,	169	10	6	to A.?
Remains £.				due to A.

9.

	£.	s.	d.	
Lent to B.	1000			
Received at one time,	100			How much
At another,	899	19	11$\frac{3}{4}$	has he now to pay me?
Received in all,	£.999	19	11$\frac{3}{4}$	
B. has to pay me,	£000	0	0$\frac{1}{4}$	Ans.

NOTE.—Here I first add the sums received together, then subtract their amount from the money lent, and find there is but one farthing due to me.

10.

Borrowed of C.	£146.10	How much is now
Paid,	90. 9.9	due to C.?
Due to C.	£	Ans.

11.

	£	s.	d.	
Lent to D.	4671	15	3¾	
Received at one time,	367	10	4	How much is
At another,	1016	4	11½	now due to
At another,	96	18	7¾	me from D.?
At another time,	9	10		
Received in all, £				
Ans. £				Remains due to me.

	From.	Take.	Remainder.
12.	£ 196 . 14 . 9¾ —	£116 . 13 . 4½ =	£80 . 1 . 5¼
13.	100 —	99 . 19 . 11¾ =	
14.	100 —	0 . 0 . 0¼ =	
15.	1269 . 10 . 3 —	978 . 11 . 9¼ =	
16.	1111 . 11 . 11 —	111 . 11 . 11¼ =	

17. Subtract one hundred and forty-nine pounds, fifteen shillings, six pence, and three farthings—from eight hundred and fifty-seven pounds. *Rem.* £707 . 4 . 5 . ¼.

18. From eight thousand nine hundred and sixty pounds, ten shillings—take six thousand and nine pounds, and ten pence. *Remainder*, £2951 . 9 . 2 d.

TROY WEIGHT.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by, in Addition of Troy Weight.

1.

	lb.	oz.	pwt.	gr.
From	167	8	16	10
Take	98	10	12	19
Rem.	68	10	3	15
Proof.	167	8	16	10

2.

	lb.	oz.	pwt.	gr.
	961	10	8	17
	576	10	4	20

3.

lb.	oz.	pwt.	gr.
141	11	19	17
31	10	17	14

4.

lb.	oz.	pwt.	gr.
425	9	12	16
110	10	19	21

5. Subtract 96 lb. 2 oz. 10 pwt. 14 gr.—from 116 lb. 10 oz. 6 pwt. 4 gr. *Remainder*, lb. 20 . 7 . 15 . 14 gr.

6. From three hundred ninety-seven pounds, nine ounces, fourteen penny-weights, sixteen grains—take forty-nine pounds, ten penny-weights, nineteen grains.
Remainder, lb. 348 . 9 . 3 . 21 gr.

AVOIRDUPOIS WEIGHT.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in Addition of Avoirdupois Weight.

1.

	T.	cwt.	qr.	lb.	oz.	dr.
From	19	11	1	27	12	12
Take	17	13	2	19	14	10
Rem.	1	17	3	7	14	2
Proof.	19	11	1	27	12	12

2.

lb.	oz.	dr.
14	14	14
3	10	7

3.

Cwt.	qr.	lb.	oz.
16	2	10	15
4	2	6	15

4.

T.	cwt.	qr.	lb.	oz.
121	16	3	10	10
97	14	1	20	15

5. Subtract 6 T. 11 Cwt. 2 qr. 19 lb. 8 oz. 12 dr.—from 13 T. 12 Cwt. 3 qr. 14 lb. 10 oz. 6 dr.
Remainder, T. 7 . 1 . 0 . 23 . 1 . 10 dr.

6. From nineteen tons, thirteen hundred, two quarters, twenty pounds, five ounces, nine drams—take eight tons, sixteen hund. wt. three quarters, twenty-four pounds, five ounces, six drams. *Rem.* T. 10 . 16 . 2 . 24 . 0 . 3 dr.

APOTHECARIES WEIGHT.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in Addition of Apothecaries Weight.

1.

	℔.	℥.	ʒ.	℈.	gr.
From	101	11	7	2	19
Take	17	2	3	1	5
Rem.	84	9	4	1	14
Proof.	101	11	7	2	19

2.

℔.	℥.	ʒ.
100	10	6
96	11	7

3.

℔.	℥.	ʒ.	℈.
16	4	1	2
14	7	7	1

4.

℔.	℥.	ʒ.	℈.	gr.
50	6	0	0	10
9	1	6	1	

5. Subtract 34 ℔. 9 ℥. 4 ʒ. 2 ℈. 16 gr.—from 93 ℔. 10 ℥. 5 ʒ. 1 ℈. 19 gr. *Remainder*, ℔ 59 . 1 . 0 . 2 . 3 gr.

6. From eighty-six pounds, four ounces, three drams, one scruple, fourteen grains—take forty-six pounds, nine ounces, four drams, nineteen grains.

Remainder, ℔ 39 . 6 . 7 . 0 15 gr.

CLOTH MEASURE.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in Addition of Cloth Measure.

1.

	Yd.	qr.	na.	in.
From	46	1	3	1
Take	42	3	1	2
Rem.	3	2	1	$1\frac{1}{4}$
Proof.	46	1	3	1

2.

Yd.	qr.	na.	in.
60	3	3	2
10	2	2	1

3.				4.				5.		
E.Fl.	qr.	na.		E.E.	qr.	na.		E.Fr.	qr.	na.
14	2	1		17	3	3		60	1	3
7	1	3		9	0	1		50	5	2

6. Subtract 14 yd. 3 qr. 2 na.—from 20 yd. 2 qr. 3 na.
Remainder, Yd. 5 . 3 . 1 na.

7. From ninety-six ells English, two quarters, three nails—take thirty-seven ells English, three quarters, two nails. *Remainder*, E.E. 58 . 4 . 1 na.

LONG MEASURE.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in Addition of Long Measure.

	1.								2.		
	Deg.	mi.	fur.	pol.	ft.	in.	bc.		Pol.	yd.	ft.
From	91	49	7	16	10	10	1		17	4	1
Take	70	54	6	31	10	10	2		3	5	1
Rem.	20	6 4½	0	24	1 5½	11	2		3	5	9
Proof.	91	49	7	16	10	10	1				
True Rem.	20	64	4	24	16	5	2				

NOTE.—To find the true remainder in whole numbers, observe the note in Compound Addition of Long Measure.

3.					4.						
Pol.	yd.	ft.	in.		Deg.	mi.	fur.	pol.	ft.	in.	bc.
50	5	2	11		8	60	6	39	10	9	0
7	2	2	9		6	7	4	5	6	7	1

5. Subtract 29 deg. 45 m. 3 fur. 30 pol. 14 ft. 6 in. 2 bc. —from 64 deg. 36 m. 5 fur. 36 pol. 2 ft. 8 in.
Remainder, Deg. 34 . 60½ . 2 . 5 . 4½ . 1 . 1 bc.

6. From seventy-five degrees, thirty-six miles, six furlongs, twenty-nine poles, fifteen feet, four inches, one barley-corn—take forty-six degrees, eighteen miles, seven furlongs, thirty poles, ten feet, six inches, two barley-corns. *Remainder*, Deg. 29 . 17 . 6 . 39 . 4 . 9 . 2 bc.

LAND, OR SQUARE MEASURE.

EXAMPLES.

Note.—Borrow from the same numbers that were carried by in Addition of Land, or Square Measure.

1.

	Acres.	rood.	pol.	feet.	in.
From	121	3	27	231	100
Take	70	0	39	271	97
Rem.	51	2	27	232¼	3
Proof.	121	3	27	331	100
True Rem.	51	2	27	232	39

2.

Yd.	ft.	in.
19	8	101
7	6	78

Note.—The easiest method of borrowing where any denomination is a large number, is as follows :—

Place above the minuend the number it takes of that denomination to make one the next higher ; then subtract the subtrahend from that number, and add the minuend to what is left for a remainder.

3.

Acres.	rood.	pol.
101	2	30
95	1	20

4.

Acres.	rood.	pol.	feet.	in.
110	1	38	161	19
7	0	9	10	11

5. Subtract 34 A. 2 R. 24 pol. 200 ft. 119 in.—from 132 A. 3 R. 19 pol. 146 ft. 98 in.

Remainder, A. 98 . 0 . 34 . 217¼ . 123 in.

6. From two hundred and seventy-eight acres, three roods, nineteen poles, one hundred and six feet, seventy-three inches—take eighty-nine acres, three roods, twenty-

seven poles, one hundred and eighty-four feet, one hundred and nine inches.

Remainder, A. 188 . 3 . 31 . 193¼ . 108 in.

NOTE.—The quarter of a foot in the remainder of the last example is equal to 36 inches, which if added to the 108 inches, would make a foot; the true answer to the question is therefore,

A. 188 . 3 . 31 . 194 ft.

SOLID MEASURE.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in addition of Solid Measure.

1.

	Ton.	ft.	in.
From	60	37	1727
Take	17	39	100
Rem.	42	38	1627
Proof.	60	37	1727

2.

Yds.	ft.	in.
61	31	1404
7	10	199

3.

Cord.	feet.	in.
10	17	1500
1	18	600

4.

Ton.	ft.	in.
101	39	140
72	16	1610

5. Subtract 54 T. 29 ft. 1267 in.—From 99 T. 31 ft. 147 in. *Rem.* T. 45 . 1 . 608 in.

6. From two hundred and sixteen tons, thirteen feet, eleven hundred and ninety seven inches—Take one hundred and nine tons, twenty-five feet, fifteen hundred inches. *Rem.* T. 106 . 27 . 1425 in.

WINE MEASURE.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in addition of Wine Measure.

1.

	Tun.	hhd.	gal.	qt.	pt.	gl.
From	69	2	44	1	1	1
Take	19	3	60	3	0	2
Rem.	49	2	46	2	0	3
Proof.	69	2	44	1	1	1

2.

Hhd.	gal.	qt.	pt.
70	55	2	1
17	44	3	0

3.

Bar.	gal.	qt.
17	30	3
5	17	2

4.

Tun.	bt.	hhd.	gal.	qt.	pt.
17	1	0	54	2	1
6	0	1	60	1	1

5. Subtract 93 T. 2 hhd. 51 gal. 3 qt. 1 pt. 2 gl.—From 112 T. 1 hhd. 49 gal. 2 qt. 1 pt. 3 gl.
Rem. T. 18 . 2 . 60 . 3 . 0 . 1 gl.

6. From two hundred and twenty-four tuns, one hogshead, thirteen gallons, one pint—Take eighty-five tuns, two hogsheads, twenty-four gallons, three quarts, two gills.
Rem. T. 138 . 2 . 51 . 1 . 0 . 2 gl.

ALE AND BEER MEASURE.

EXAMPLES.

Note.—Borrow from the same numbers that were carried by in addition of Ale and Beer Measure.

1.

	Butt.	hhd.	gal.	qt.	pt.	gl.
From	99	1	44	2	1	2
Take	19	0	30	3	0	3
Rem.	80	1	13	3	0	3
Proof.	99	1	44	2	1	2

2.

Bar.	gal.	qt.
64	19	3
32	16	2

3.

Hhd.	gal.	qt.
16	19	3
14	53	2

4.

Hhd.	gal.	qt.	pt.	gl.
12	50	3	1	2
9	6	1	1	0

5. Subtract 86 Hhds. 17 gal. 2 qts. 1 pt.—from 174 Hhds. 10 gal. 1 qt. 1 pt.

Rem. Hhds. 87 . 46 . 3 . 0 pt.

6. From one hundred and sixteen hogsheads, thirty-nine gallons, two quarts,—take seventy-seven hogsheads, forty-four gallons, three quarts, one pint.

Rem. Hhds. 38 . 48 . 2 . 1 pt.

DRY MEASURE.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in addition of Dry Measure.

1.

	Bu.	pk.	gal.	qt.	pt.	gl.
From	120	2	1	2	0	3
Take	98	1	0	1	1	0
Rem.	22	1	1	0	1	3
Proof.	120	2	1	2	0	3

2.

Bu.	pk.	qt.	pt.
51	2	6	1
9	1	4	0

3.

Pk.	gal.	qt.	pt.
16	1	3	0
15	1	3	0

4.

Bu.	pk.	qt.	pt.
19	2	7	0
17	1	6	1

5. Subtract 139 bu. 2 pk. 3 qts. 1 pt.—from 567 bu. 1 pk. 2 qts. *Rem.* Bu. 427 . 2 . 6 . 1 pt.

6. From two hundred and eighty-four bushels, one peck, two quarts—take one hundred and ninety-seven bushels, two pecks, four quarts, one pint.

Rem. Bu. 86 . 2 . 5 . 1 pt.

TIME.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in addition of Time.

1.

	Yr.	mo.	w.	da.	h.	m.	s.
From	31	10	2	4	7	24	49
Take	10	10	2	2	7	59	14
Rem.	21	0	0	1	23	25	35
Proof.	31	10	2	4	7	24	49

2.

Yr.	mo.	da.
17	10	17
6	0	6

3.

Yr.	da.	h.
210	310	10
19	70	10

4.

Yr.	da.	h.	m.	s.
17	100	7	50	7
16	99	6	39	6

5. Subtract 29 Yr. 10 mo. 2 w. 4 d. 16 h. 34 m. 45 s. —from 81 yr. 6 mo. 3 w. 1 d. 21 h. 16 s.

Rem. Yr. 51 . 9 . 0 . 4 . 4 . 25 . 31 s.

6. From thirty-four years, nine months, three weeks, five days, fourteen hours, forty-five minutes, thirty seconds—take twenty-five years, ten months, six days, fifty seconds. *Rem.* Yr. 8 . 12 . 2 . 6 . 14 . 44 . 40 s.

MOTION.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in addition of Motion.

1.

	S.	°	′	″
From	11	17	49	59
Take	7	16	18	19
Rem.	4	1	31	40
Proof.	11	17	49	59

2.

°	′	″
10	41	17
10	40	51

3.		
S.	°	′
11	26	51
6	17	19

4.			
S.	°	′	″
9	10	17	40
4	10	17	39

5. Subtract 4s. 14°. 34′. 23″.—from 10s. 11°. 16′. 39″.
Remainder, 5s. 26°. 42′. 16″:

6. From nine signs, twenty-four degrees, seventeen minutes, thirty-one seconds—take six signs, nine degrees, forty-five minutes, fifty-four seconds.
Remainder, 3s. 14°. 31′. 37″.

PARTICULARS.

EXAMPLES.

NOTE.—Borrow from the same numbers that were carried by in Addition of Particulars.

1.

	Reams.	Quires.	Sheets.
From	140	15	16
Take	97	16	9
Rem.	42	19	7
Proof.	140	15	16

2.

Reams.	Quires.	Sheets.
191	17	21
76	8	22

3.

Hund.	Score.	S.things.
760	2	17
498	4	18

4.

G.Gross.	Gross.	Doz.	S.things.
79	9	2	11
19	11	9	8

REDUCTION.

REDUCTION, teaches to change numbers of one denomination, into others of different denominations, retaining the same value.

Reduction is of two sorts, viz.—Descending and Ascending.

Reduction Descending, is when high denominations are to be brought into lower; as pounds into shillings, pence, &c.; years into days, hours, &c.

RULE.

Multiply the highest denomination given, by so many of the next less, as make one of that highest; adding into the product, those of the same name as the multiplier; thus continue to multiply the several denominations, until the given sum is reduced as low as the question requires.

Reduction Ascending, is when low denominations are to be brought into higher; as farthings into pence, shillings, &c.; ounces into pounds, quarters, &c.

RULE.

Divide the lowest denomination given, by so many of that name as makes one of the next higher; and so on from one denomination to another, until the given sum is brought into the denomination required: the last quotient, with the several remainders, (if any,) will be the answer.

NOTE.—The remainders, (if any,) will be parts of the same name as the divisor.

PROOF.

Change the order of the question, and divide the last product by the last multiplier; or, multiply the last quotient by the last divisor, and so on, as the nature of the question requires.

NOTE.—Reduction Descending and Ascending reciprocally prove each other.

QUESTIONS.

What is Reduction? How many sorts of Reduction are there?
What is Reduction Descending?
How are high denominations brought into lower?
What is Reduction Ascending?
How are low denominations brought into higher?
How is Reduction proved?

FEDERAL MONEY.

EXAMPLES.

1. In 64 eagles, 5 dollars, 9 dimes, 7 cents, and 6 mills; how many mills?

	E. D. d. c. m.	
	64 5 9 7 6	
Multiply the eagles by	10	because 1 eagle is equal to 10 dollars; and add in the 5 dolls.
	645	dollars, in 64 eagles, and 5 dolls.
Multiply the dollars by	10	because 1 dollar is equal to 10 dimes; and add in the 9 dimes.
	6459	dimes, in 645 dolls. and 9 dimes.
Multiply the dimes by	10	because 1 dime is equal to 10 cents; and add in the 7 cents.
	64597	cents, in 6459 dimes, and 7 cents.
Multiply the cents by	10	because 1 cent is equal to 10 mills; and add in the 6 mills.
Answer,	645976	or, number of mills contained in 64 E. 5 D. 9 d. 7 c. 6 m.

NOTE.—As Federal Money increases, or decreases in a ten-fold proportion, from one denomination to another; the answer to the above question might have been obtained, without making any more figures, than barely setting down the several denominations without the separating points:—

E. D. d. c. m.
Thus; 64 . 5 . 9 . 7 . 6

Answer, 645976 Mills.

NOTE 1.—Notwithstanding the last operation is so simple and plain to those who understand arithmetic; still it was thought best to adhere strictly to the rules of Reduction.

NOTE 2.—Connecting the several denominations together, as above, is equal to multiplying the highest, &c. by so many times 10.

2. In 645976 mills; how many eagles?

Divide the mills by 10, to reduce them to cents; because it takes 10 mills to make a cent.
Divide the cents by 10, to reduce them to dimes; because it takes 10 cents to make a dime.
Divide the dimes by 10, to reduce them to dollars; because it takes 10 dimes to make a dollar.
Divide the dolls. by 10, to reduce them to eagles; because its takes 10 dollars to make an eagle.
Eagles.
Dollars, that were left.
Dimes, that were left.
Cents, that were left.
Mills, that were left.

```
   Mills.    10       10      10    E.  D. d. c. m.
10)645976(64597(6459(645(64  5  9  7  6 Answer.
   60       60      60    60
   ---      ---     ---   ---
    45       45      45    45
    40       40      40    40
    ---      ---     ---   ---
     59       59      59    5 $ left.
     50       50      50
     ---      ---     ---
      97       97     9 dimes left.
      90       90
      ---      ---
       76     7 cents left.
       70
       ---
     6 mills left.
```

NOTE.—This sum is worked by Long Division, and every necessary explanation given to convince the pupil, that, (provided the foregoing rules are strictly adhered to,) there is nothing difficult to perform in reduction; still the answer to the foregoing question might have been obtained, by pointing off from the mills, the several denominations:—

Thus; 645976 mills.

```
     E.  D. d. c. m.
Ans. 64 . 5 . 9 . 7 . 6
```

NOTE 1.—Pointing off the several denominations as before observed; is equal to dividing the lowest, &c. by so many times 10.

NOTE 2.—This second example proves the first; and every example in Reduction, either proves the one immediately preceding, or following it.

3. In 679 dollars, 45 cents, 6 mills; how many mills?

	$ cts. m.	
	679 45 6	
Multiply the dollars by	100	the No. of cents in a dollar; and add in the 45 cents.
	67945 cents.	
Multiply the cents by	10	the No. of mills in a cent; and add in the 6 mills.
Answer,	679456	or, No. of mills there are in $679 45 cts. 6 m.

NOTE.—The answer to this question might have been obtained, by setting down the several denominations, as one whole number:—

$ c. m.
Thus; 679 45 6

Answer, 679456 Mills.

NOTE.—Connecting the several denominations as above, is equal to multiplying the dollars by 100, and the cents by 10.

4. In 679456 mills; how many dollars?

Divide by 10, the mills in a ct. 1|0)67945|6 mills.

Divide by 100, the cts. in a dol. 1|00)679|45 cents.

Answer, $679 45c. 6m.

NOTE.—This answer was obtained by Short Division, agreeable to the rule laid down in Simple Division, case 4th; where the divisor is 10, 100, &c. It might however have been contracted, by pointing off the several denominations,

Thus; 679456 mills.
$ c. m.
679 . 45 . 6 *Answer*.

NOTE.—The reason for pointing off one figure for mills, and two for cents; is, because there are 10 mills in a cent, and 100 cents in a dollar. It gives the same answer, as if the mills were divided by 10, to reduce them to cents, and the cents by 100, to reduce them to dollars.

5. In 24 eagles, how many cents? *Ans.* 24000.

6. In 24000 cents; how many eagles? *Ans.* 24.

7. In 39050 cents; how many half johannes, at 8 dollars each?

```
1|0 0)3 9 0|5 0
      ---------
     8)3 9 0 . 5 0
      ---------
Ans. H.J. 4 8.6$.5 0c.
      ---------
```

NOTE.—In this example, I reduce the cents to dollars; then divide by 8, the number of dollars in a half joe.

8. In 48 half johannes, 6 dollars, 50 cents; how many cents? *Ans.* 39050.

9. In 1000 crowns, at 110 cents each; how many dollars? *Ans.* 1100.

10. In 1100 dollars; how many crowns? *Ans.* 1000.

11. In 4697 mills; how many cents? *Ans.* $469\frac{7}{10}$.

12. In $469\frac{7}{10}$ cents; how many mills? *Ans.* 4697.

13. In 54 guineas, at $4, 66 cts. 7 m. each; how many dollars?

```
       4 6 6 7
           5 4
   -----------
     1 8 6 6 8
   2 3 3 3 5
   -----------
Ans. $2 5 2.0 1.8m.
   -----------
```

NOTE.—Here I set down the value of a guinea in mills, and multiply them by the number of guineas; the answer is therefore mills; the right hand figure I point off for mills, the two next for cents, the rest are dollars.

14. In $252. 01c. 8m.; how many guineas, at 4$. 66 cts. 7m. each? *Ans.* 54.

15. In 342 dollars; how many moidores, at $6 each? *Ans.* 57.

16. In 57 moidores at $6 each; how many dollars? *Ans.* 342.

17. In 3670 cents; how many dollars? *Ans.* $36 . 70.

18. In $36 . 70; how many cents? *Ans.* 3670.

ENGLISH MONEY.

EXAMPLES.

1. In 23 £. 14 s. 9 d. 2 qrs.; how many farthings?

	£. s. d. qrs.	
	23 14 9 2	
Multiply the pounds by	20	the No. of shillings in a £. and add in the 14 s.
	474	shillings, in 23 £. 14 s.
Multiply the shillings by	12	the No. of pence in a shilling, and add in the 9 d.
	5697	pence, in 23 £. 14 s. 9 d.
Multiply the pence by	4	the No. of farthings in a penny, and add in the 2 qrs.

Answer, 22790 farthings, in 23£. 14s. 9d. 2 qrs.

NOTE.—The reason for multiplying the pounds by 20, to reduce them to shillings; the shillings by 12, to reduce them to pence; and the pence by 4, to reduce them to farthings;—is, because there are in any sum, 20 times as many shillings, as pounds; 12 times as many pence as shillings; and 4 times as many farthings, as pence.

2. In 22790 farthings; how many pounds?

Divide the farthings by 4, to reduce them to pence.	Divide the pence by 12, to reduce them to shil'gs.	Divide the shillings by 20, to reduce them to pounds.	Pounds.	Shillings left.	Pence left.	Farthings left.
qrs.	12	20	£.	s.	d.	qrs.

```
4)22790(5697(474(23  14  9  2 Ans.
  20      48     40
  --      --     --
   27      89     74
   24      84     60
   --      --     --
    39      57     14 shil-
    36      48  lings left.
    --      --
     30      9 pence left.
     28
     --
2 farthings, or ½ penny left.
```

NOTE.—This sum is worked by Long Division; it being much easier for new beginners to understand, than Short Division. It is however worked again by Short Division, for their satisfaction.

Again.

4)2 2 7 9 0 farthings.

1 2)5 6 9 7 — 2 qrs.

2|0)4 7|4 — 9 d.

Ans. £2 3 . 1 4 . 9½.

NOTE 1.—In this second operation, I divide the farthings by 4, and find two farthings left—the pence by 12, and find 9 pence left—the shillings by 20, and find a quotient of 23 pounds, and 14 shillings left; therefore the quotient, with the several remainders agree with the first operation.

NOTE 2.—The reason for dividing farthings by 4, to reduce them to pence; and pence by 12, to reduce them to shillings; and shillings by 20, to reduce them to pounds; is, because there are not in any sum, but one fourth part as many pence, as farthings —but one twelfth part as many shillings, as pence—and but one twentieth part as many pounds, as shillings.

3. In £46 . 18 . 10¾; how many farthings?

	£.	s.	d.	
	4 6	1 8	1 0¾	
Multiply by	2 0			the shillings in a £.
				shillings in 46£. 18s.
Multiply by	1 2			the pence in a s.
				pence in 46£. 18s. 10d.
Multiply by	4			the farthings in a d.
Answer,	4 5 0 6 7			farthings in £46 . 18 . 10¾d.

4. In 45067 farthings; how many pounds?

Divide the qrs. by 4)4 5 0 6 7

Divide the d. by 1 2)

Divide the s. by 2 0)

Answer, £46 . 18 . 10¾.

5. In 6669 pence; how many pounds?

Ans. 27£. 15s. 9d.

6. In 27£. 15s. 9d.; how many pence?

Ans. 6669 d.

7. In 85680 pence; how many pounds?

Ans. 357 £.

8. In 357 £.; how many pence? *Ans.* 85680 d.

9. In 846 dollars, at 6s. each; how many farthings?

```
     $ 8 4 6
           6
     -------
     5 0 7 6 s.
         1 2
     ---------
   6 0 9 1 2 d.
           4
   -----------
Ans. 2 4 3 6 4 8 qrs.
```

NOTE.—In this example, I multiply first by 6, the number of shillings in a dollar; then by 12, the number of pence in a shillings; then by 4, the number of farthings in a penny.

10. In 243648 farthings; how many dollars at 6s. each? *Ans.* $ 846.

11. Reduce 5555412 farthings, to pounds. *Ans.* £ 5786 . 17 . 9.

12. Reduce 5786£. 17s. 9d., to farthings. *Ans.* 5555412 qrs.

13. In 49£. 16s. 9d. 2 qrs.; how many farthings? *Ans.* 47846 qrs.

14. In 47846 farthings; how many pounds? *Ans.* £49 . 16 . 9 . 2.

15. In 23799 farthings; how many pounds? *Ans.* £24 . 15 . 9 . 3.

16. In 24£. 15s. 9d. 3qrs.; how many farthings? *Ans.* 23799 qrs.

17. In £60; how many dollars, at 8s. each?

```
          £
        6 0
        2 0
     -------
  8 ) 1 2 0 0
     -------
Ans. $ 1 5 0
```

NOTE.—In this example, I reduce the pounds to shillings; then divide them by the number of shillings in a dollar.

18. In 150 dollars, at 8s. each; how many pounds? *Ans.* £60.

19. In 84£. 7s. 6d.; how many dollars, at 7s. 6d. each? *Ans.* 225.

20. In 225 dollars, at 7s. 6d. each; how many pounds?

```
   $          s.  d.
  2 2 5       7   6
    9 0     1 2
  --------   ---
1 2) 2 0 2 5 0    9 0 d. in 7s. 6d.
  -----------
2|0) 1 6 8|7 — 6
  -----------
Ans.  £8 4.7.6
```

NOTE.—I first reduce a dollar to pence, by which number I multiply the dollars; the product is pence; which I then reduce to pounds.

21. In £964; how many sixpences? *Ans.* 38560.

22. In 38560 sixpences; how many pounds? *Ans.* £964.

23. In 964 eight-pences, and 964 four-pences; how many dollars at 6s. each?

```
Eight-pences.   Four-pences.
   9 6 4          9 6 4
       8              4
  -------        -------
  7 7 1 2d.      3 8 5 6d.
    3 8 5 6
  ---------
1 2) 1 1 5 6 8d.
  ---------
    6) 9 6 4s.
       -----
Ans. $1 6 0 . 4s.
```

NOTE.—In this example I first reduce the eight pences, and four-pences to pence; and add them together; then reduce the sum in pence to dollars, by dividing them by 12, and that quotient by 6.

24. In $160, 4s.; how many eight-pences, and four-pences, of each a like number? The dollar valued at 6s. *Ans.* 964.

25. In 29 guineas, at 28 shillings each; how many farthings? *Ans.* 38976.

26. In 38976 farthings; how many guineas, at 28s. each? *Ans.* 29.

27. In 19674 pence; how many shillings? *Ans.* 1639s. 6d.

28. In 1639s. 6d.; how many pence? *Ans.* 19674.

29. In 3120d.; how mamy shillings? *Ans.* 260s.

30. In 260s.; how many pence? *Ans.* 3120d.

31. In £434; how many shillings? *Ans.* 8680s.

32. In 8680s.; how many pounds? *Ans.* £434.

33. In 20552 pence; how many farthings?
Ans. 82208qrs.

34. In 82208 farthings; how many pence?
Ans. 20552d.

TROY WEIGHT.

EXAMPLES.

1. In 366491 grains; how many pounds?

Divide by 24, the grains in a pwt.	Divide by 20, the pwts. in an ounce.	Divide by 12, the ounces in a pound.	Pounds.	Ounces left.	Penny wts. left.	Grains left.
grs.	20	12	lb.	oz.	pwt.	gr.
24)366491(	15270(	763(	63	7	10	11 *Ans.*
24	140	72				
126	127	43				
120	120	36				
64	70	7 oz. left.				
48	60					
169	10 pwt. left.					
168						
11 gr. left.						

NOTE.—I here divide the grains by 24, to reduce them to penny weights; the penny weights by 20, to reduce them to ounces; the ounces by 12, to reduce them to pounds: and find that in 366491 grs., there are 63lbs. 7oz. 10pwts. 11grs.

2. In 63 lb. 7 oz. 10 pwt. 11 gr.; how many grains?
Ans. 366491 gr.

3. In 13 bars of gold, each weighing 9 oz. 5 pwt.; how many grains? *Ans.* 57720 gr.

4. In 57720 grains; how many bars of gold, each weighing 9 oz. 5 pwt. *Ans.* 13.

5. In 275520 grains; how many pounds?
Ans. 47 lb. 10 oz.

6. In 47 lb. 10 oz.; how many grains?
Ans. 275520.

AVOIRDUPOIS WEIGHT.

EXAMPLES.

1. In 12 tons, 15 cwt. 1 qr. 19 lb. 6 oz. 12 dr.; how many drams?

```
                  T.  cwt. qr.  lb.  oz. dr.
                  1 2  1 5  1   1 9   6  1 2
Multiply by         2 0, because 20 cwt. make a T.
                ------
                2 5 5 cwt.
Multiply by         4, because 4 qrs. make a cwt.
              --------
              1 0 2 1 qr.
Multiply by         2 8, because 28 lbs. make 1/4 of a cwt.
            ----------
              8 1 8 7
            2 0 4 2
            ----------
            2 8 6 0 7 lb.
Multiply by         1 6, because 16 oz. make a lb.
          ------------
          1 7 1 6 4 8
          2 8 6 0 7
          ------------
          4 5 7 7 1 8 oz.
Multiply by         1 6, because 16 dr. make an oz.
          --------------
          2 7 4 6 3 2 0
          4 5 7 7 1 8
          --------------
Ans.      7 3 2 3 5 0 0 drams.
          --------------
```

2. In 7323500 drams; how many tons?
Ans. 12 T. 15 cwt. 1 qr. 19 lb. 6 oz. 12 dr.

3. Reduce 1720320 drams to tons. *Ans.* 3 tons.

4. Reduce 3 tons, to drams. *Ans.* 1720320 dr.

5. In 470 bags of sugar, each weighing 26 lbs.; how many cwt. *Ans.* 109 cwt. 0 qr. 12 lb.

6. In 109 cwt. 0 qr. 12 lb. of sugar; how many bags, each weighing 26 lbs. *Ans.* 470.

APOTHECARIES WEIGHT.

EXAMPLES.

1. In 9℔. 8℥. 1ʒ. 2℈. 19 gr.; how many grains?

```
                ℔.  ℥.  ʒ.  ℈.  gr.
                 9   8   1   2  19
Multiply by     12, because 12℥. make a ℔.
               ---
               116 ℥.
Multiply by      8, because 8ʒ. make an ℥.
               ---
               929 ʒ.
Multiply by      3, because 3℈. make a ʒ.
              ----
              2789 ℈.
Multiply by     20, because 20 gr. make a ℈.
             -----
Ans.         55799 gr.
```

2. In 55799 grains; how many pounds? *Ans.* 9℔. 8℥. 1ʒ. 2℈. 19 gr.

3. In 1000 grains; how many pounds? *Ans.* 0℔. 2℥. 0ʒ. 2℈. 0 gr.

4. In 0℔. 2℥. 0ʒ. 2℈. 0 gr.; how many grains? *Ans.* 1000 gr.

WINE MEASURE.

EXAMPLES.

1. In 201600 gills; how many tuns?

NOTE 1.—In this example, I first divide by 4, because 4 gills make a pint; and then by 2, because 2 pints make a quart; then by 4, because 4 qts. make a gallon; then by 63, because 63 gals. make a hogshead; and then by 4, because 4 hhds. make a tun: and find that in 201600 gills, there are 25 tuns.

```
 4)2 0 1 6 0 0 gills.
   -----------
 2)5 0 4 0 0 pts.
   ---------
 4)2 5 2 0 0 qts.
   ---------   4
63)6 3 0 0(1 0 0(25T. An.
   6 3        8
   ---       --
     0 0     2 0
             2 0
             --
```

NOTE 2.—This answer is obtained, partly by short, and partly by long division.

2. In 25 tuns; how many gills? *Ans.* 201600.

3. In 3 hhds. 13 gals. 2 qts.; how many half pints? *Ans.* 3240.

4. In 3240 half pints; how many hogsheads? *Ans.* 3 hhd. 13 gals. 2 qts.

ALE, OR BEER MEASURE.

EXAMPLES.

1. In 47 bbl. 18 gal. of ale; how many pints?

```
                  bbl.  gal.
                  4 7   1 8
Multiply by         3 6, because 36 gal. make a bbl.
                -------
                3 0 0
              1 4 1
              -------
              1 7 1 0 gal.
Multiply by         4, because 4 qts. make a gal.
              -------
              6 8 4 0 qt.
Multiply by         2, because 2 pts. make a qt.
            ---------
   Ans.     1 3 6 8 0 pts.
```

2. In 13680 pints of ale; how many barrels, each containing 36 gallons? *Ans.* 47 bar. 18 gal.

3. In 50112 gills of beer; how many hogsheads? *Ans.* 29 hhds.

4. In 29 hhds. of beer; how many gills? *Ans.* 50112 gls.

DRY MEASURE.

EXAMPLES.

1. In 18752 pints; how many bushels?

```
            4          2          4
2)1 8 7 5 2(9 3 7 6(2 3 4 4(1 1 7 2(2 9 3  Answer.
  1 8         8        2          8
  ---        ---      ---        ---
    7        1 3        3        3 7
    6        1 2        2        3 6
   ---       ---       ---       ---
    1 5        1 7     1 4         1 2
    1 4        1 6     1 4         1 2
    ---        ---     ---         ---
      1 2        1 6     4
      1 2        1 6     4
      ---        ---     -
```

NOTE.—In this example, I first divide by 2, because 2 pints make a quart; then by 4, because 4 quarts make a gallon; then by 2, because 2 gallons make a peck; then by 4, because 4 pecks make a bushel: and find that in 18752 pints, there are 293 bushels.

2. In 293 bushels; how many pints? *Ans.* 18752.

3. In 720 bushels of corn; how many barrels, each containing 3 bush. 3 pks.? *Ans.* 192.

4. In 192 barrels of corn, each containing 3 bush. 3 pks.; how many bushels? *Ans.* 720 bushels.

CLOTH MEASURE.

EXAMPLES.

1. Reduce 47 yds. 2 qrs. to nails.

```
                    Yds. qrs.
                     4 7  2
Multiply by             4, because 4 qrs. make a yard.
                  ------
                  1 9 0 qr.
Multiply by             4, because 4 na. make ¼ of a yard.
                  ------
        Ans.      7 6 0 nails.
```

2. Reduce 760 nails, to yards. *Ans.* 47 yds. 2 qrs.
3. In 120 yds.; how many Ells English? *Ans.* 96.
4. In 96 Ells English; how many yds.? *Ans.* 120.
5. In 29 pieces of Holland, each containing 36 Ells Flemish; how many yards? *Ans.* 783.
6. In 783 yards; how many pieces of Holland, each containing 36 Ells Flemish? *Ans.* 29.

LONG MEASURE.

EXAMPLES.

1. In 190080 inches; how many leagues?

```
                    5½
                    2
                   ---
        3           11
12)190080(15840(    5[illegible]0
   12      15             2
   --      --       ------- 40   8  3
   70       8   11)10560)960(24(3(1 L. An.
   60       6       99   80  24 3
   --      --       --   --  -- -
   100     24       66  160
    96     24       66  160
   ---     --       --  ---
    48               0
    48
    --
     0
```

NOTE.—In this example, I first divide by 12, because 12 inches make a foot; then by 3, because 3 feet make a yd.; I reduce the 5½ to halves, and double the yds.; I then divide the half yards by 11, because 11 half yards make a rod; then by 40, because 40 rods make a furlong; then by 8, because 8 furlongs make a mile; then by 3, because 3 miles make a league: and find there is in 190080 inches, 1 league.

2. In 1 league; how many inches? *Ans.* 190080in.

3. In 29 miles; how many inches? *Ans.* 1837440 in.

4. In 1837440 inches; how many miles? *Ans.* 29m.

5. How many times will a wheel of 16 feet, and 6 inches in circumference, turn round, in the distance of 42 miles? *Ans.* 13440.

NOTE.—In this example, reduce the circumference of the wheel to inches; then the 42 miles to inches: then divide the distance in inches, by the circumference of the wheel in inches.

6. If a wheel 16 feet, and 6 inches in circumference, turns round 13440 times; how many miles does it run? *Ans.* 42 miles.

LAND, OR SQUARE MEASURE.

EXAMPLES.

1. In 241 acres, 3 roods, and 25 poles, how many square poles?

```
                 A.   R.  P.
                241   3   25
Multiply by           4, because 4 roods make an acre.
                ----------
                967 roods.
Multiply by      40, because 40 poles make a rood.
            -------------
    Ans.  38705 square poles.
```

2. In 38705 square poles; how many acres? *Ans.* 241 ac. 3 roods, 25 p.

3. In 7752 square feet; how many square rods? *Ans.* 28 rods, 129 feet.

4. In 28 Rs. 129 ft.; how many square ft.? *Ans.* 7752.

SOLID MEASURE.

EXAMPLES.

1. In 1313280 solid inches; how many tons of round timber?

```
                      40     T.
1728)1313280(760(19 Ans.
      12096    40
      -----    ---
       10368   360
       10368   360
       -----   ---
           0
```

NOTE.—In this example I first divide by 1728, because 1728 solid inches make a foot;—then by 40, because 40 solid feet make a ton.

2. In 19 tons of round timber; how many solid inches?
Ans. 1313280.

3. In 1296000 solid inches; how many tons of hewn timber?
Ans. 15.

4. In 15 tons of hewn timber; how many solid inches?
Ans. 1296000.

5. In a pile of wood, 96 feet long, 5 feet high, and 4 feet wide; how many cords?
Ans. 15.

6. What must be the length of a pile of wood, that is 5 feet high, and 4 feet wide, to make 15 cords?

1 2 8, the feet in a cord.
1 5, the number of cords.

6 4 0
1 2 8

Heighth, 5)1 9 2 0

Width, 4)3 8 4

Ans. 9 6 feet.

NOTE.—Here I first multiply the number of feet in a cord, by the number of cords; then divide by the heighth, and width of the pile, and find it must be 96 feet long.

TIME.

EXAMPLES.

1. In 631152000 seconds; how many years of $365\frac{1}{4}$ days each?

$365\frac{1}{4}$
4
1461

60 24
60)6 3 1 1 5 2 0 0 0(1 0 5 1 9 2 0 0(1 7 5 3 2 0(
6 0 6 0 1 6 8

3 1 1 4 5 1 7 3
3 0 0 4 2 0 7 2

1 1 5 3 1 9 1 2 0
6 0 3 0 0 1 2 0

5 5 2 1 9 2
5 4 0 1 8 0

1 2 0 1 2 0
1 2 0 1 2 0

0 0 0

7 3 0 5
4
Ans.
1461)2 9 2 2 0(20 Y.
2 9 2 2

0

NOTE.—In the preceding example, I first divide by 60, because 60 seconds make a minute; then by 60, because 60 minutes make an hour; then by 24, because 24 hours make a day; I reduce the $365\frac{1}{4}$ to quarters, and multiply the days by 4; then divide the quarter days by 1461, because 1461 quarter days make a year; and find, that in 631152000 seconds, there are 20 years.

2. In 20 years; how many seconds?
Ans. 631152000 sec.

3. In 344 w. 6 d. 17 h.; how many hours?
Ans. 57953 h.

4. In 57953 hours; how many weeks?
Ans. 344 w. 6 da. 17 h.

5. How many seconds are there in a solar year, or 365 days, 5 hrs. 48 min. and 48 sec. *Ans.* 31556928 sec.

6. In 31556928 seconds; how many years?
Ans. 1 yr. 5 hr. 48 m. 48 sec.

MOTION.

EXAMPLES.

1. In 1020300 seconds; how many degrees?

```
                          60
60)1 0 2 0 3 0 0(1 7 0 0 5(2 8 3° 2 5' Answer.
   6 0           1 2 0
   -----         -----
   4 2 0           5 0 0
   4 2 0           4 8 0
   ---------       -------
         3 0 0       2 0 5
         3 0 0       1 8 0
         -----       -----
                       2 5
```

NOTE.—In this example, I first divide by 60, because 60 seconds make a minute; then by 60, because 60 minutes, or miles make a degree: and find, that in 1020300 seconds, there are 283° 25'.

2. In 283° 25'; how many seconds?
Ans. 1020300 sec.

3. In 6 signs; how many minutes? *Ans.* 10800m.

4. In 10800 minutes; how many signs? *Ans.* 6 s.

PARTICULARS.

EXAMPLES.

1. In 9 reams of paper; how many sheets?

	Reams.	
	9	
Multiply by	2 0,	because 20 Quires make a Ream.
	1 8 0	Quires.
Multiply by	2 4,	because 24 sheets make a Quire.
	7 2 0	
	3 6 0	
Ans.	4 3 2 0	sheets.

2. In 4320 sheets of paper; how many reams? *Ans.* 9.

3. In 475 lb.; how many score? *Ans.* 23 score, 15 lb.

4. In 23 score, 15 lb.; how many pounds? *Ans.* 475 lb.

5. In 4775 tacks; how many gross? *Ans.* 33 gross, 1 doz. 11 tacks.

6. In 33 gross, 1 doz. 11 single tacks; how many tacks? *Ans.* 4775.

COMPOUND MULTIPLICATION.

Compound Multiplication, is the multiplying a compound number, or, numbers composed of different denominations, by any simple number.

Multiplicand, is the number to be multiplied.
Multiplier, is the number to multiply by.
Product, is the number found by multiplying.
Factors, are both the multiplier, and multiplicand.

Case 1.—*When the price is given in Federal Money.*

RULE.

Set down the price of one yard, gallon, &c, as one whole number.

Multiply the price by the quantity, or the quantity by the price, and the product will be the answer to the question, in the least denomination mentioned in the price.

NOTE 1.—If there be mills in the price, point off the right hand figure of the product for mills, the two next for cents, and the remaining left hand figures, (if any,) will be dollars.

NOTE 2.—If the least denomination in the price be cents, point off the two right hand figures of the product for cents, and the left hand figures, (if any,) will be dollars.

NOTE 3.—If dollars only, are mentioned in the price, the product will be dollars.

NOTE 4.—When there are dollars and cents in any sum, and the number of cents be less than 10, prefix a cypher to them, thus :—for 7 cents, write 07 ;—which is equal to $\frac{7}{100}$ of a dollar, or 7 cents.

PROOF.

Divide the product by the multiplier; and the quotient, (if the work is right,) will be equal to the given sum.

NOTE.—Multiplication of Federal Money may also be proved by casting out the nines.

Case 2.—*When the quantity does not exceed* 12 *yards, gallons, &c. and the price is given in English Money.*

RULE.

Place the quantity underneath the lowest denomination in the price.

Multiply the lowest denomination first, and if the product be not equal to the number it takes of that denomination to make one of the next higher; set it down under the denomination multiplied.

If the product equals, or exceeds that number; divide it by so many of that denomination, as make one of the next higher; set down the remainder, (if any,) under the denomination multiplied, and carry the quotient to the product of the next higher denomination.

Proceed thus, to the highest, or last denomination, which multiply, and set down, as in Simple Multiplication.

Case 3.—*When the quantity exceeds 12 yards, gallons, &c. and the price is given in English money.*

RULE.

Multiply the quantity by each denomination in the price separately.

Reduce the products of the lower, to the higher denominations: add them together, and their sum will be the total product or answer.

Case 4.—*When the quantity exceeds 12, and is a composite number.*

RULE.

Multiply the price by one of two such numbers, as when multiplied together, will produce the given quantity; and that product by the other number, and the last product will be the answer.

Case 5.—*When several articles of equal weight or measure are given, with the weight or measure of one, to find the weight or measure of the whole.*

RULE.

Multiply the weight or measure of one, by the given number; and the product will be the weight or measure of the whole.

QUESTIONS.

What is Compound Multiplication? What is Multiplicand?
What is Multiplier? What is Product? What are Factors?
When the price is given in Federal Money; what is the rule of work?
How is Compound Multiplication proved?
When the quantity does not exceed 12, and the price is given in English Money; how is the work performed?
When the quantity exceeds 12, and the price is given in English Money; how must we proceed?
When the quantity is a composite number, how do we multiply by it?
When several articles of equal weight or measure are given with the weight of one; how is the weight of the whole found?
What are the names of the terms made use of in Multiplication?

EXAMPLES.

Case 1.—*Where the price is given in Federal Money.*

1. What will 3 yards of cloth come to, at $1 . 09 . 6 per yard?*

Price,	1 0 9 6 mills.	yds.	mills.
Quantity,	3 yards.	3)	3 2 8 8
Ans.	$3 . 2 8 . 8 } value of 3 yards.		$1 . 0 9 . 6 Proof, by division.

Note 1.—In this first example, I set down the price of one yard, as so many mills, and multiply them by the quantity, or number of yards—the product is 3288 mills; the right hand figure of which I point off for mills, the two next for cents; the remaining left hand figure is dollars.

The answer will read thus—three dollars, twenty-eight cents, eight mills, which is the value of 3 yds. at $1 . 09 . 6 per yard.

Note 2.—To prove the work, I set down the answer, or price of the whole in mills, and divide them by the quantity; the quotient is 1096 mills; the right hand figure of which I point off for mills, the two next for cents, the remaining left hand figure is dollars.

The proof will read thus—one dollar, nine cents, six mills;—which is the value of one yard, at $3 . 28 . 8 for 3 yards.

2. How much will 9 yards of cloth come to, at $6.75 per yard?

Price,	6 . 7 5 cents.	0
Quantity,	9 yards.	0×0 Proof,
Ans.	$6 0 . 7 5 } value of 9 yards.	0 by casting out the nines.

Note 1.—I here set down the price of one yard, as so many cents, and multiply them by the quantity; the product is cents; the two right hand figures of which, I point off for cents; the left hand figures are dollars.

Note 2.—To prove the work, I cast out the nines from the multiplicand, multiplier, and product; the same as in Simple Multiplication: and as the upper and lower figures, or cyphers are alike; I conclude the work is right.

* This, and every succeeding example in this case, proves that of the same Case, and number, in Compound Division.

3. What is the value of 22 yards of cloth, at $8 per yard?

Quantity,	2 2 yards.		
Price,	8 dollars.		
Ans.	$1 7 6	value of 8 yds.	

NOTE.—Here I first set down the qnantity, and multiply by the price; the product is one hundred and seventy-six dollars.

4. What will 3 yards of cloth cost, at $5 . 80 pr. yd.?
Ans. $17 . 40.

5. What cost 4 yards of cloth, at $1 . 11 per yard?
Ans. 4 . 44.

	What cost		dol.	cts.	m.		*Answer.*
6.	5 yards,	at	1	07	1	per yard?	$ 5.35.5.
7.	6 lbs.	„	2	87	5	per lb.?	17.25.0.
8.	7 gals.	„		50	0	per gal.?	3.50.0.
9.	8 yards,	„	8	20	0	per yard?	65.60.0.
10.	9 lbs.	„	1	16⅔		per lb.?	10.50.0.

NOTE.—In this example, I first take one third of the quantity, by dividing it by 3; then set the third down again, whose sum is equal to ⅔ of 9.

Price, 1 1 6⅔ Cents.
⅓) 9 Quantity.

3=⅓ } both of which 3ds,
3=⅓ } are equal to ⅔ of 9.

1 0 4 4

Ans. $1 0 . 5 0 price of 9 lbs.

	What cost		dol.	cts.	m.		*Answer.*
11.	10 gal.	at	2	75	3	per gal.	$27.53 .0
12.	11 do.	„	4	79¾		do.	52.77¼
13.	12 yards,	„	6	76	0	per yd.	81.12 .0
14.	24 do.	„	1	05¼		do.	25.26 .0
15.	35 bushels,	„	1	21	2	per bus.	42.42 .0

16. What will 84 yards of cloth cost, at 16 cents per yard?
Ans. $13 . 44.

17. What will 755 yards of tape cost, at 8 mills per yard?
Ans. $6 . 04 . 0.

18. What cost 385 bbls. of pork, at $25 per bbl.?
Ans. $9625.

19. What cost 398 bbls. of beef, at $12 per bbl.?
Ans. $4776.

20. What cost 14½ bbls. of flour, at $10 . 50 per bbl.?

```
      Cents.
½) 1 0 5 0  price of 1 bbl.
       1 4½ number of bbls.
   -------
     5 2 5  price of half a bbl.
   4 2 0 0
 1 0 5 0
 ---------
Ans. $1 5 2.2 5 price of 14½ bbls.
```

NOTE.—In this example, I first take half of the price of one barrel, by dividing it by 2; then multiply by the number of barrels.

	What cost		dol. cts. m.		Answer.
21.	24½ yards, at		1 05 2	per yd.	$ 25.77 .4
22.	183	,, ,,	20 7	,,	37.88 .1
23.	473	,, ,,	1 65 6¼	,,	783.40 .6¼
24.	27	,, ,,	10 25	,,	276.75 .0
25.	57½	,, ,,	37	,,	21.27½
26.	570	,, ,,	5	,,	2.85 .0

27. What will 12¼ cwt. of sugar come to, at $14.75, per cwt.?

NOTE.—In this ample, I first take one fourth of the price of a cwt. by dividing it by 4.

```
      Cents.
¼) 1 4 7 5  price 1 cwt.
       1 2¼ cwt.
   -------
     3 6 8¾ price of ¼ of a cwt.
   2 9 5 0
 1 4 7 5
 ---------
Ans. $1 8 0.6 8¾ price of 12¼ cwt.
```

	What cost.		dol. cts. m.		Answer.
28.	9½ lbs. at		4 25	per lb.	$ 40.37.5
29.	3¼	,, ,,	40	,,	130
30.	76	,, ,,	1 19 4	,,	90.74.4
31.	99	,, ,,	9 99 9	,,	989.90.1
32.	446	,, ,,	3	,,	1.33.8
33.	15	,, ,,	87	,,	13.05
34.	1¼	,, ,,	1 01 3	,,	1.26.6¼
35.	100	,, ,,	16 5	,,	16.50.0

36. To what will $26\frac{3}{4}$ lb. of tea amount to, at \$2 . 40 per pound.

NOTE.—In this example, I first take half of the price of a lb., by dividing it by 2: then half of that half by dividing it by 2; both of which halves, are equal to $\frac{3}{4}$.

	Cents.	
$\frac{1}{2}$)	2 4 0	price of a lb.
	2 $6\frac{3}{4}$	No. of lbs.
$\frac{1}{2}$)	1 2 0	price of $\frac{1}{2}$ a lb. } $=\frac{3}{4}$ of
	6 0	price of $\frac{1}{4}$ of a lb. } 240 cts.
	1 4 4 0	
	4 8 0	
Ans.	\$6 4 . 2 0	price of $26\frac{3}{4}$ lbs.

37. What cost $23\frac{3}{4}$ yds. of cloth, at \$10 . 10 . 1 per yd.? *Ans.* \$239 . 89 . $8\frac{3}{4}$.

38. What cost 2 cwt. 3 qrs. 24 lb. of sugar, at 9 cents per lb.?

	Cwt.	qr.	lb.
	2	3	2 4
	4		
	1 1		
	2 8		
	1 1 2		
	2 2		
Quan'ty.	3 3 2 lbs.		
Price,	9 cts.		
Ans.	\$2 9 . 8 8		

NOTE.—In this example, I first reduce the weight to pounds, then multiply the number of pounds, by the price of a pound; and find the answer to be \$29 . 88

39. What cost $8\frac{1}{2}$ cwt. of rice, at 5 cts. per lb.? *Ans.* \$47 . 60.

40. What cost 11 cwt. 3 qrs. 19 lb. of Tobacco, at 7 cts. per lb. *Ans.* \$93 . 45.

EXAMPLES.

Case 2.—*Where the quantity does not exceed* 12, *and the price is given in English Money.*

1. What cost 2 yds. of cloth, at £1 . 3 . 9 per yd.?*

	£.	s.	d.			£.	s.	d.	
Price,	1	3	9		Yds. 2)	2	7	6	Price of 2 yds.
Quantity,			2 yds.						
Value of 2 yds.	£2 .	7 .	6	*Ans.*	val. of 1 yd.	£1 .	3 .	9	Proof.

NOTE 1.—I here say, twice 9 is 18; then 12 is in 18, 1, and 6 left; the 6d. I set down, and the 1s. I carry to the next product, which makes 7; and as there are no pounds in 7s. I set them down, and proceed on to the 1 pound, the product of which is 2; the answer therefore to the question is £2 . 7 . 6.

NOTE 2.—To prove the work, I divide the price of 2 yards by 2, thus,—2 is in 2, 1, and nothing remains; then 2 is in 7, 3 and 1 remains; the 1s. left, I reduce to pence, and add in the 6d. which makes 18; then 2 is in 18, 9; which with the other quotients, is £1 . 3 . 9; the price of 1 yard.

NOTE 3.—Although the above sum is proved, and an explanation of the work given; still I do not think it advisable for the pupil to prove compound multiplication, without a competent knowledge of compound division.

2. What cost 3 yards of cloth, at 12s. 7½d. per yd.?

	s.	d.	qrs.
Price,	1 2	7	2
Quan'y.			3 yds.
	2|0)3|7	1 0	2
Ans.	£1 . 1 7 .	1 0½	

NOTE.——After multiplying the price of 1 yd. by 3, I find the product to be 37s. 10d. 2qrs.—the 37s. I divide by 20, to reduce them to pounds; I then find the answer to be £1 . 17 . 10 . 2 qrs. or ½d.

3. What cost 12 yards of cloth, at 9d. per yd.?

Price,	9 d.
Quantity,	1 2 yds.
	1 2)1 0 8
	Ans. 9s.

NOTE.——After multiplying the price by the quantity, I find the product to be 108 pence, which I divide by 12, to reduce them to shillings; the answer is then 9 shillings.

4. What is 2 yds. of cloth worth, at £1 . 12 . 9 per yd.?
Ans. £3 . 5 . 6.

* This case proves case 2d, in Compound Division, to sum 17.

5. What will 3 yds. of cloth come to, at 34s. 9¾d. per yard?

Price, £1 . 14 . 9 . 3
Quantity, 3 yds.

Ans. £5 . 4 . 5 . 1

NOTE.—Thirty-four shillings, nine pence, three farthings; is equal to one pound, fourteen shillings, nine pence, three farthings.

6. What will 4 lbs. of tea cost, at 6s. 8d. per lb.? *Ans.* £1 . 6 . 8.

7. What will 5lbs. of coffee come to, at 1s. 10¼d. pr. lb.? *Ans.* 9s. 3¼d.

8. What cost 6½ yards of cloth, at 19s. 11¼d. per yd.?

2)19 11 1 Price.
6½ Quantity.

9 11 2½ price of ½ of a yd.
119 7 2 price of 6 yds.

2|0)12|9 7 0½

An. £6 . 9 . 7 . 0½ price of 6½ yds.

NOTE 1.—To find the value of ½ a yd.—I divide the price of a yard by two.

NOTE 2.—Here the am't. is 129s. 7d.: the shillings I divide by 20, to reduce them to pounds: the answer is £6.9.7d. 0½ qrs.

9. Bought 7 lbs of Indigo, for 13s. 6d. per lb.; what did I give for the whole? *Ans.* £4 . 14 . 6.

10. Sold 8 yards of cloth, at 49s. 2½d. per yd.; how much did the whole come to? *Ans.* £19 . 13 . 8.

	What cost	£	s.	d.		*Answer.*
11.	9 Yards, at	0	7	0	per yd.	£ 3 . 3 . 0
12.	10 lbs. ,,	0	16	6¼	per lb.	8 . 5 . 2½
13.	11 Cwt. ,,	1	8	9½	per Cwt.	15 . 16 . 8½
14.	12 bbls. ,,	2	0	6¾	per bbl.	24 . 6 . 9

15. What will 8¾ yds. of cloth amount to, at 10½d. per yard?

d. qrs.
½)10 2 Price.
8¾ Quantity.

½)5 1=to ½ of 10d. 2qr.
2 2½=to ¼ of 5d. 1qr.
84 0

12)91 3½

Ans. 7s. 7d. 3½qrs. Price of 8¾ yds. at 10½d. per yd.

NOTE.—For the ¾ of a yard in the quantity, I first take half of the price, then half of that half: both of which halves are equal to ¾ of 10d. 2 qrs.

16 What will 10¼ yds. of cloth amount to, at £2 . 8 per yd.? *Ans.* £24 . 12.

EXAMPLES.

Case 3.—*Where the quantity exceeds* 12, *and the price is given in English Money.*

1. What cost 13 yds. of cloth, at 23s. 4½d. per yard ?*

Quantity,	1 3 Yds.	2)1 3 Yds.
Price,	2 3 s.	4½d.
	3 9	6½d. at ½d. per yd.
	2 6	5 2d. at 4d. per yd.
	2 9 9	1 2)5 8½d. at 4½d. per yd.
	4 . 1 0½d.	4s. 1 0½d.
	2|0)3 0|3 . 1 0½	Price of 13 yds. at 4½ per yd.; which add to the price at 23s.
Ans.	£1 5 . 3 . 1 0½	

NOTE.—Here I multiply the 13 yards, by the 23 shillings, the product of which is 299 shillings.—I then multiply the 13 yards by the 4½ pence, the product of which is 58½ pence: these I reduce to shillings, and add to the 299 shillings, which makes 303 shillings, 10½ pence: these I reduce to pounds, and find the answer to be £15 . 3 . 10½.

2. What is the value of 17 yds. of cloth, at 55s. 7d. per yard? *Ans.* £47 . 4 . 11.

3. What cost 19 yds. of cloth, at 4s. 10½d. per yd.? *Ans.* £4 . 12 . 7½.

4. What cost 20 lbs. of tea, at 3s. 1d. per lb.? *Ans.* £3 . 1 . 8.

5. What cost 24 yds. of cloth, at 6s. 3¾d. per yard?

Quan'y.	24 yds.	½) 24 yds.
Price,	6 s.	3¾ d.
	144	½) 12=½ of 24 } =¾ of 24
	7.6	6=½ of 12 }
	2|0)15|1.6	72
Ans.	£7.11.6	12)90
		7s. 6d.

NOTE.—7s. 6d. is the price of 24 yds. at 3¾d. per yd.: which I add to the price at 6s. pr. yd.: that sum I divide by 20, the shillings in a pound: and find the answer to the question to be £7 . 11 6.

* This case proves Case 2d in Compound Division, from sum 17th, and onward.

6. What will 35 bushels of wheat cost, at 7s. $3\frac{1}{4}$d. per bushel? *Ans.* £12 . 14 . $5\frac{3}{4}$.

7. What will 84 gallons of gin cost, at 5s. $7\frac{1}{2}$d. per gallon? *Ans.* £23 . 12 . 6.

8. What cost 68 yds. of cloth, at 22s. $6\frac{1}{4}$d. per yard? *Ans.* £76 . 11 . 5.

9. What will $67\frac{1}{2}$ yds. of cloth cost, at 16s. $3\frac{1}{4}$d. pr. yd.?

Yds.	Yds.
$67\frac{1}{2}$ Quantity.	$\frac{1}{4}$) $67\frac{1}{2}$ Quantity.
$\frac{1}{2}$) 16s. Price.	$\frac{1}{2}$) $3\frac{1}{4}$d. Price.
8=to $\frac{1}{2}$ of 16s.	$16\frac{3}{4}=\frac{1}{4}$ of 67 yards.
402	$1\frac{1}{2}=\frac{1}{2}$ of $3\frac{1}{4}$d.
67	201
1080s. } The price at 16s. per yd.	12)$219\frac{1}{4}$d.
$18.3\frac{1}{4}$ } the price at $3\frac{1}{4}$d. pr. yd.	s.$18.3\frac{1}{4}$d. } the price at $3\frac{1}{4}$d. pr. yd. which add to the 1080s.
2|0)109|$8.3\frac{1}{4}$	

Ans. £$54.18.3\frac{1}{4}$ Value of $67\frac{1}{2}$ yds. at 16s. $3\frac{1}{4}$d. per yd.

NOTE.—After placing the price in shillings, and the price in pence under the quantity; I begin with the shillings and say, half of 16s. is 8s.; the value of $\frac{1}{2}$ a yard, at 16s. per yard; then multiply the 67 yds. by the 16s. and add the product and quotient together; the sum of which is 1080s.

I then begin with the pence, and take $\frac{1}{4}$ of the 67 for the $\frac{1}{4}$ of a penny, which is equal to $16\frac{3}{4}$ pence—then take $\frac{1}{2}$ of the $3\frac{1}{4}$d. for the $\frac{1}{2}$ yard—then multiply the 67 yards by the 3 pence, and add the product and quotients together; the sum of which is $219\frac{1}{4}$d. which I reduce to shillings, and add them to the price at 16s.; this sum I reduce to pounds; and find that $67\frac{1}{2}$ yards, at 16s. $3\frac{1}{4}$d. per yard; is equal to £54 . 18 . $3\frac{1}{4}$d. the answer.

10. What cost 97 yards of cloth, at 25s. 3d. per yd.? *Ans.* £122 . 9 . 3.

11. What is the value of 100 bbls. of flour, at 55s. 6d. per barrel? *Ans.* £277 . 10.

12. What will 144 bushels of wheat come to, at 16s. $6\frac{1}{2}$d. per bushel? *Ans.* £119 . 2.

13. What will 165 yds. of cloth cost, at £1 . 3 . 6 per yard ?

Yds. or	Yds. or	Yds. or
£165, at £1 pr.yd.	165s. at 1s. pr.yd.	165d. at 1d. pr.yd.
24 . 15	3s.	6d.
4 . 2 . 6	2|0)49|5	12)990
An. £193 . 17 . 6	£24.15 } Price at 3s. pr.yd.	2|0)8|2.6d.
		£4.2.6 } Price at 6d.pr.yd

NOTE.—I here first set down the 165 yards, as so many pounds, at £1 per yard; I then set down the yards again, and multiply them by the 3s. the product of which I reduce to pounds; I then set them down again, and multiply them by the 6d., and reduce that product to pounds; I then place the price at 3s. and the price at 6d. under the price at £1 per yard; which sums I add together, and find the total sum or answer to be £193 . 17 . 6.

14. What cost 137¼ yds. of cloth, at 3s. 8¼d. per yd. ?
Ans. £25 . 6 . 1¼.

	What cost		*Answers.*
15.	300 yds. at £0 . 13 . 6	per yd.	£202 . 10 . 0
16.	769¾ lb. „ 1 . 10	per lb.	70 . 11 . 2½
17.	980 bbls. „ 2 . 2 : 6½	pr. bbl.	2084 . 10 . 10

18. What cost 1 cwt. of flour, at 4½d. per lb. ?

2) 112 the lbs. in a cwt.
4½d the price of a lb.

56=½ of 112.
448=4 times 112.

12)504d. value in pence.

2|0)4|2s. val. in shillings.

Ans. £2.2 value in pounds and shillings.

NOTE.—I here set down the pounds in a cwt., and multiply them by the price of a pound; first by taking one half, then multiplying by 4.

19. What is the value of 1 cwt. of indigo, at 9s. 6d. per lb. ? *Ans.* £53 . 4.

20. What cost 5 cwt. of indigo, at 8s. 11½d. per lb. ?
Ans. £250 . 16 . 8.

21. What cost 5 cwt. 3 qr. 19 lb. of sugar, at 1s. 1½d. per lb.?

lbs.	lbs.
or 663s.	or 663d.
82 . 10½ val. at 1½d.	1½d.
2|0)74|5 . 10½	331½ = ½ of 663.
	663
Ans. £37 . 5 . 10½	
	12)994½(82s. which add to
	96 the 663s.
	34
	24
	10½d. left.

Note.—I first reduce the weight to lbs., which is equal to 663 lbs.: and 663 lbs. at 1s. per lb., is equal to 663s., or 663d., at 1d. per lb.

22. What cost 8 Cwt. 2 qrs. of rice, at 5d. per lb.? *Ans.* £19 . 16 . 8.

23. Multiply £.0 15s. 10d. by 512. *Ans.* £405 . 6 . 8.

24. Multiply 5s. 6d. by 1000. *Ans.* £275.

EXAMPLES.

Case 4.*—*Where the quantity exceeds* 12, *and is a composite number.*

1. What cost 16 yds. of cloth, at £1 . 6 . 9 per yd.?

£	s.	d.	
1	6	9	
		4	
£5	7	0	val. of 4 yds.
		4	
Ans. £21	8	0	val. of 4 times 4, or 16 yds.

Note.—4 times 4 yds., is equal to 16 yds.; I therefore multiply the price of 1 yard, by 4, and that product by 4; which gives the price of 16 yards.

2. What will 18 yds. of cloth come to, at 27s. 2½d. per yd.? *Ans.* £24 . 9 . 9.

	What cost.	£	s.	d.		*Answers.*
3.	25 yds. at	0	3	1	per yd.	£ 3 . 17 . 1.
4.	28 lbs. „		6	5¾	per lb.	9 . 1 . 5.
5.	33 gal. „	1	13	4	per gal.	55 . 0 . 0.
6.	44 yds. „		12	4½	per yd.	27 . 4 . 6.

* This case is proved by case 3d. in Compound Division.

7. What cost 96 gals. of brandy, at 11s. 9d. per gal.? *Ans.* £56 . 8 0.

8. What cost 121 yds. of cloth, at 23s. 3½d. per yd.? *Ans.* £140 . 18 . 3½.

9. What will 144 yds. of cloth come to, at 24s. 2d. per yard? *Ans.* £174.

EXAMPLES.

Case 5.—*Where the weight or measure of one article is given, to find the weight or measure of several.*

1. What is the whole weight of 2 Silver Cups, each weighing 9oz. 12pwt. 14gr.?*

	oz.	pwt.	gr.	
	9	12	14	wt. of one.
			2	
lb. 1 .	7 .	5 .	4	*Answer.*

NOTE 1.—I here put down the wt. of 1 cup, and multiply it by the number of cups.

NOTE 2.—In multiplying the ounces, the product is 18, and 1 that I carry is 19; this sum I divide by 12; the remainder, 7, I set down under the ounces, and the 1 lb. I carry forward to the place of pounds.

2. What is the weight of 1 doz. silver spoons, each weighing 3oz. 6pwt.? *Ans.* 3lb. 3oz. 12pwt.

3. What is the weight of 7 tierces of rice, each weighing 5cwt. 2qr. 16lb.? *Ans.* 39cwt. 2qr.

4. What is the weight of 4 packages of medicine, each package weighing 3℔. 4℥. 6ʒ. 1℈. 16gr.?

Ans. 13℔. 7℥. 2ʒ. 1℈. 4gr.?

5. How many yards of cloth in 36 pieces, each piece containing 25yds. 3qrs.? *Ans.* 927 yds.

6. How far will a man travel in 5 days, at the rate of 24mi. 4fur. 4rods per day? *Ans.* 122mi. 4fur. 20r.

7. What is the quantity of land in 9 fields, each field containing 12A. 2roods, and 25pol. *Ans.* 113A. 3r. 25p.

8. In a wall 30 feet long, 10 feet high, and 4 feet thick, how many solid feet? *Ans.* 1200.

NOTE.—Multiply the length by the heighth, and that product by the thickness.

9. How much brandy is contained in 25 hhds., each hhd. guaging 61gal. 1qt. 1pt.? *Ans.* 1534gal. 1qt. 1pt.

* This case is proved by case 4th, in Compound Division.

10. In 7 butts of beer, each containing 1 hhd. 34 gals. 3 qts.; what are the contents of the whole?

Ans. 5B. 1hhd. 27gal. 1qt.

11. In 8 bags of wheat, each containing 2 bushels, 3 pecks, and 1 gallon; how much wheat in the whole?

Ans. 23 bush.

12. If a man work for me 12 hours, 45 minutes per day, for 9 days in succession, for how much time must I pay him? *Ans.* 114h. 45m.

13. If a Captain of a vessel sail his ship at the rate of 2 degrees, 34 minutes, and 16 seconds, each day, for 10 days together—how far did he proceed in that time on his voyage? *Ans.* 25deg. 42m. 40s.

COMPOUND DIVISION.

COMPOUND DIVISION, teaches to find how many times any simple number is contained in a compound number, or a number composed of different denominations.

Dividend, is the number to be divided.

Divisor, is the number to divide by.

Quotient, is the number found by dividing.

Remainder, is the number left after dividing.

Case 1.—*When the sum to be divided is Federal Money.*

RULE.

Place the quantity for a divisor, at the left of the price, or dividend; and proceed as in simple division; the quotient will be the answer to the question, in the lowest denomination mentioned in the price.

NOTE 1.—If the sum to be divided consists of dollars only, the quotient will be dollars.

Should there be any thing left, annex two cyphers to the remainder and divide for cents.

Should there still be a remainder, annex another cypher, and divide again for mills.

NOTE 2.—If the answer be mills, point off the right hand figure of the quotient for mills, the two next for cents, and the remaining left hand figures, (if any,) will be dollars.

Should the answer be cents, point off the two right hand figures for cents, and the left hand figures, (if any,) will be dollars.

NOTE 3.—When the divisor does not exceed 12; the work can be performed *mentally*, or by *Short Division*; in which case, place the several quotients under their respective denominations.

PROOF.

Multiply the quotient by the divisor, and the product, (if the work is right,) will be equal to the dividend.

NOTE.—Division of Federal Money, may also be proved by casting out the nines.

Case 2.—*When the sum to be divided is English Money.*

RULE.

Place the quantity or divisor, at the left hand of the price or dividend; divide first the highest denomination in the price, by the quantity, and place the quotient at the right of the dividend. If any thing remain, reduce it to the next lower denomination, and add in the figures of the same name.

Divide this sum as before, and the quotient will be in the same denomination, as that to which the remainder was reduced.

If the number of either denomination be not sufficient to contain the divisor, place a cypher in the quotient, and reduce it to the next lower denomination.

Proceed as before directed, through all the different denominations; and the quotients will be the answer to the question, in the several denominations to which the sum was reduced.

Case 3.—*When the quantity exceeds* 12, *and is a composite number, i. e. a number which may be produced by multiplying two numbers together.*

RULE.

Divide the price by one of two such numbers, as will produce the given quantity, then that quotient by the other, and the last quotient will be the answer.

NOTE.—If there be a remainder in one, or both operations, multiply the first divisor by the last remainder; add the first remainder (if any) to the product, and that sum will be the true remainder.

Case 4.—*When the whole weight or measure of several articles are given, to find the weight or measure of one.*

RULE.

Divide the weight, or measure of the whole, by the number of articles, and the quotient will be the weight, or measure of one.

Case 5.—*When the shares of partners are equal.*

RULE.

Divide the given sum by the number of partners, and the quotient will be the share of one.

Case 6.—*When the shares of partners are unequal.*

RULE.

Find how many of the first, or least simple share, is contained in the whole number of shares.

Divide the given sum by the number of shares, and the quotient will be the value of the first, or simple share.

Multiply a simple share by the number of shares belonging to each partner separately; and the product will be their portion of the given sum.

PROOF.

Add the shares of all the partners together; which sum, if the work is right, will be equal to the dividend.

QUESTIONS.

What does Compound Division teach?

What is meant by dividend? What is meant by divisor?

What is meant by quotient? What is meant by remainder?

When the price of any quantity is given in Federal Money; how do we proceed?

How is Compound Division proved?

When the price is given in English Money; what is the rule?

When the quantity is a composite number, how is the work performed?

When the weight or measure of several articles are given; how do we find the weight or measure of one?

When the shares of partners are equal; how do we find the share of each?

When the shares of partners are unequal; how is the share of each found, and how is the work proved?

EXAMPLES.

Case 1.—*Where the given sum is Federal Money.*

1. If 3 yds. of cloth, cost $3 . 28 . 8 how much is it per yard.?*

Yds. mills. $ cts. m.
3)3 2 8 8(1 09 6 *Ans.*
3
—— By long division.
2 8
2 7
——
1 8
1 8
——

$1 . 0 9 . 6 mills.
3 yds.
————
$3 . 28 . 8 Proof, by multiplication.

Yds. mills.
3)3 2 8 8
————
Ans. $1.0 9.6
————
By short division.

NOTE.—In the above example, I set down the price of the whole as so many mills; then divide by the quantity, and the quotient is 1096 mills; the right hand figure of which, I point off for mills, the two next for cents, and find the price of 1 yard to be $1 . 09 . 6.

To prove the work, I multiply the price of one yard, by the number of yards, and find the product equal to the dividend.

2. If 9 yards of cloth, cost $60 . 75, how much is that per yd.?

Yds. mills. $ cts.
9)6 0 7 5(6 . 75 *Ans.*
5 4
—— By long divis.
6 7
6 3
——
4 5
4 5
——

Yds. mills.
9)6 0 7 5
————
An. $6.7 5 By short division.
9
————
$6 0.7 5 Proof by multiplication.
————

NOTE.—In this example, I set down the price of the whole, as so many cents, and divide by the quantity, and find the answer to be 675 cents, or $6 . 75.

3. If 22 yds. of cloth, cost $176, what is it per yd.?

Yds. $ $
2 2)1 7 6(8 *Ans.*
1 7 6
——

5
8×4
5
Proof, by casting out the nines.

NOTE.—In this example I divide the price of the whole by the quantity, and find the answer to be eight dollars.

* This and every succeeding example in this case, proves the one of the same case, and number in Compound Multiplication.

4. If 3 yds. of cloth, cost $17 . 40, what is it per yd.?
Ans. $5 . 80.

5. If 4 yds. of cloth, cost $4 . 44; what is it per yd.?
Ans. $1 . 11.

		dol. cts. m.			dol. cts. m.
6.	Divide	5 35 5,	by 5.	*Ans.*	1 07 1.
7.	Divide	17 25 0,	by 6.	*Ans.*	2 87 5.
8.	Divide	3 50 0,	by 7.	*Ans.*	50 0.

9. If 8 yds. of cloth cost $65 . 60, how much is it pr. yd.?
Ans. $8 . 20.

10. If 9 bushels of wheat cost $10 . 50, how much is it per bushel? *Ans.* $1 . 16⅔.

11. If $27 . 53, be divided equally among 10 persons, what is the share of each? *Ans.* $2 . 75 . 3.

		dol. cts. m.			dol. cts. m.
12.	Divide	52 77 2½	by 11.	*Ans.*	4 79 7½.
13.	Divide	81 12	by 12.	*Ans.*	6 76.

14. If 24 yds. of cloth cost $25 . 26, what is it pr. yd.?

```
     $ cts. m.
24)2 5 2 6(1 0 5 2½ Ans.
   2 4
   ----
     1 2 6
     1 2 0
     -----
         6 0
         4 8
         ---
         1 2=to ½ of 24, the divisor, or, ½ of 1 mill.
```

6
8×6 Proof,
6
by casting out the nines.

15. If 35 bushels of rye cost $42 . 42, how much is it per bushel? *Ans.* $1 . 21 . 2.

16. If 84 yds. of cloth cost $13 . 44, what is it pr. yd.?
Ans. 16 cts.

17. If 755 yds. of tape cost $6 . 04, how much is it per yard? *Ans.* 8 mills.

18. Divide $9625 by 385. *Ans.* $25.

19. Divide $4776 by 398. *Ans.* $12.

20. If 14½ bbls. of flour cost $152 . 25, how much is it per barrel?

1 4½)1 5 2 2 5(
2 2
dol. cts.
2 9)3 0 4 5 0(1 0 5 0
2 9 *Ans.*
1 4 5
1 4 5
0

NOTE 1.—Here I multiply the 14 by 2, and add in the ½, to bring it into halves.

NOTE 2.—I double the dividend, because I doubled the divisor. The answer is therefore the same as if there had been no alteration made in either the dividend or divisor.

21. If 24½ lbs. of tea cost $25 . 77 . 4, how much is it per lb.? *Ans.* $1 . 05 . 2.

22. If 183 lbs. of coffee cost $37 . 88 . 1, how much is it per lb.? *Ans.* $0 . 20 . 7.

		dol.	cts.	m.			dol.	cts.	m.
23.	Divide	783	40	6¼	by 473.	*Ans.*	1	65	6¼.
24.	Divide	276	75		by 27.	*Ans.*	10	25.	
25.	Divide	21	27	5	by 57½.	*Ans.*		37.	
26.	Divide	2	85		by 570.	*Ans.*			5.

27. If 12¼ cwt. of sugar cost $180 . 68 . 7½, how much is it per cwt.?

Quantity. Price in mills.
1 2¼)1 8 0 6 8 7½(
4 4
$. cts. m.
4 9)7 2 2 7 5 0(14 75 0 *Answer.*
4 9
2 3 2
1 9 6
3 6 7
3 4 3
2 4 5
2 4 5
0

NOTE 1.—I multiply the 12 cwt. by 4, and add in the quarter, to bring it into quarters.

NOTE 2.—I multiply the dividend by 4, because I did the divisor; which alteration, does not in the least affect the quotient; for the alteration made, was equally the same, in both the divisor and dividend.

28. If 9½ cwt. cost $40 . 37 . 5, how much is it pr. cwt.? *Ans.* $4 . 25.

29. If 3¼ cwt. cost $130, how much is it per cwt.? *Ans.* $40.

		dol. cts. m.			dol. cts. m.
30.	Divide	90 74 4	by 76.	*Ans.*	1 19 4.
31.	Divide	989 90 1	by 99.	*Ans.*	9 99 9.
32.	Divide	1 33 8	by 446.	*Ans.*	3.
33.	Divide	13 05	by 15.	*Ans.*	87.

34. If 1¼ yds. of cloth cost $1 . 26 . 6¼, how much is it per yard? *Ans.* $1 . 01 . 3.

35. If 100 lbs. of sugar cost $16 . 50, how much is it per lb.? *Ans.* $0 . 16 . 5.

36. If 26¾ lbs. of tea cost $64 . 20, how much is it per pound? *Ans.* $2 . 40.

37. If 23¾ yds. of cloth cost $239 . 89 . 8¾, how much is it per yard? *Ans.* $10 . 10 . 1.

38. If 2 cwt. 3 qrs. 24 lb. of sugar cost $29 . 88, what is it per lb.?

```
Cwt. qr.  lb.      lbs.  cents.
  2   3   2 4      3 3 2)2 9 8 8(9 cents, Answer.
  4                      2 9 8 8
 ---                     -------
 1 1
 2 8
-----
1 1 2
2 2
-----
3 3 2 lbs.
-----
```

Note.—In this example I reduce the weight to pounds, then set down the price as so many cents, and divide them by the weight; and find that 332, the number of pounds, is contained in 2988, the number of cents, 9 times; which is equal to 9 cents for 1 lb.

39. If 8½ cwt. of rice, cost $47 . 60; how much is it per lb.? *Ans.* 5 cents.

40. If 11 cwt. 3 qrs. 19 lb. of tobacco, cost $93 . 45; how much is it per lb.? *Ans.* 7 cents.

EXAMPLES.

Case 2.—*Where the price is given in English Money.*

1\. If 2 yds. of cloth cost £2 7 . 6; how much is it per yard ?*

yd.	£.	s.	d.	£. s. d.		£.	s.	d.		yd.	£.	s.	d.
2)	2	7	6(	1 3 9 *Ans.*		1	3	9		2)	2	7	6
	2			by long divis.				2					
											£1 . 3 . 9 *Ans.*		
		7(3s.			Proof, £2 . 7 . 6						by short divis.		

6
1
1 2
1 8(9d.
1 8

NOTE.—In this example I set down the price of the 2 yds., and divide first the pounds; the quotient of which is £1—then the shillings; the quotient of which is 3s.—the 1s. left, I multiply by 12, and add in the 6d.—this sum I divide for pence, the quotient of which is 9d.—the answer to the question is therefore £1 . 3 . 9.

To prove the work, I multiply the price of one yard, or quotient, by the No. of yards; and find this product equal to the dividend.

2\. If 3 yds. of cloth cost £1 . 17 . 10½; what is it pr. yd. ?

Yds.	£.	s.	d.	£. s. d.	Yds.	£.	s.	d.
3)	1	17	10½(	0 12 7½ Ans.	3)	1	17	10½
	20			by long division.				
					Ans.	£0 . 12 . 7½		
	37(12s.					by short division.		

3
7
6
1
12
22(7d.
21
1
4
6(2qrs.
6

NOTE.—Here I say, 3 is in 1£. no times, and place a cypher in the quotient; I then reduce the 1£ to shillings, and add in the 17s.; this sum I divide for shillings, and the 1 shilling left I reduce to pence, and add in the 10d.; this sum I divide for pence, and the 1d. left, I reduce to farthings and add in the ½d. or 2 qrs.;—this sum I divide for farthings, and find the quotient or answer to be £0 . 12 . 7½.

* This, and the 15 following sums, prove case 2d in Compound Multiplication.

3. If 12 yds. of cloth cost 9s.; how much is it per yd.?

```
12) 9(0s. 9d. Ans.        12)9               0  9
    12 by long divis.     ------             12
   ----                 s.0 . 9d. Ans.     -----
   108(9d.                ------           s.9 . 0d.
   108                  by short division.   Proof.
```

NOTE.—Here I say, 12 is contained in the 9s. no times, and place a cypher in the quotient; I then reduce the 9s. to pence, and find that 12 is contained in the 108 pence, 9 times, and nothing left; the answer to the question is therefore 9d.

4. If 2 yds. of cloth be worth £3 . 5 . 6; what is the value of one yard? *Ans.* £1 . 12 . 9.

5. If 3 yds. of cloth be worth £5 . 4 . 5¼; what is it per yard? *Ans.* £1 . 14 . 9¾.

```
            £.  s.  d.                  £.  s.  d.
6. Divide   1   6   8 by 4.   Quotient, 0   6   8
7. Divide       9   3¼d. by 5                1  10¼
```

8. If 6½ yds. of cloth cost £6 . 9 . 7 . 0½ qr.; how much is it per yard?

```
              £.    s.    d.   qrs.
Quantity, 6½) 6     9     7    0½( Price.
          2                    2
         ---  ----------------------£.  s.  d.
         1 3)1 2   1 9    2    1(0  19  11¼ Answer.
             2 0
            ----
            2 5 9(19s.
            1 3
            ----
            1 2 9
            1 1 7
            -----
              1 2
              1 2
            -----
            1 4 6(11d.
            1 3
            -----
              1 6
              1 3
              ---
                3
                4
              ---
              1 3(1 qr.
              1 3
```

NOTE 1.—I reduce the quantity to halves, by multiplying the whole number by 2, and bringing in the 1 half, which is equal to 13 halves.

NOTE 2.—I double the price or dividend, because I doubled the divisor; then divide the product of the price, by the product of the quantity; both of which being reduced equally alike, the answer is the same, as if neither had been altered; for £12 . 19 . 2¼, will measure 13, the same number of times, as £6 . 9 . 7 . 0½, will measure 6½.

9. Bought 7 lb. of indigo for £4 . 14 . 6; how much was it per lb.? *Ans.* £0 . 13 . 6.

10. Sold 8 yds. of cloth for £19 . 13 . 8; how much did I sell it per yard? *Ans.* £2 . 9 . 2½.

		£.	s.	d.			£.	s.	d.
11.	Divide	3	3	0	by 9.	*Ans.*	0	7	0.
12.	Divide	8	6	2½	by 10.	*Ans.*	0	16	7¼.
13.	Divide	15	16	8½	by 11.	*Ans.*	1	8	9½.
14.	Divide	24	6	9	by 12.	*Ans.*	2	0	6¾.

15. If 8¾ yds. of cloth cost 7s. 7d. 3½qrs.; how much is it per yard? *Ans.* 10½d.

16. If 10¼ yds. of cloth cost £24 . 12; how much is it per yard? *Ans.* £2 . 8.

17. If 13 yds. of cloth cost £15 . 3 . 10½d; how much is it per yard?*

```
yds. £. s. d.  £. s. d.
 13)15 3 10½(1 3 4½ An.
    13
    —
     2
    20
    —
    43(3s.
    39
    —
     4
    12
    —
    58(4d.
    52
    —
     6
     4
    —
    26(2 qrs.
    26
    —
```

Note.—Here I divide the price by the quantity, and find the answer to be £1 . 3 . 4½—I then prove the work by multiplication.

```
           Yds.              Yds.             Yds.
           13 or £.          13 or s.         2)13 or d.
           1£.               3s.              4½d.
           —                 —                —
          £13                39s.             6½d.
             2.3.10½.         4.10½d.         52
           ————              ————             —
Proof. £15.3.10½.        2|0)4|3 . 10½.      12)58½d.
           ————              ————             ————
                           £2 . 3 . 10½.     s.4 . 10½d.
                             ————             ————
```

Note.—To prove the work, I multiply the No. of yds., by the pounds in the price; then by the shillings; then by the pence; then reduce the lower, to the higher denominations, and add them together; and find the sum of the products, equal to the dividend.

18. If 17 yds. of cloth cost £47 . 4 . 11.; how much is it per yard? *Ans.* £2 . 15 . 7.

* This, and the following sums, prove case 3d, in Compound Multiplication.

19. Suppose I buy 19 yards of cloth for £4 . 12 . $7\frac{1}{2}$; how much did I give per yard? *Ans.* £0 . 4 . $10\frac{1}{2}$.

20. If I receive £3 . 1 . 8 for 20lb. of tea; for how much did I sell it per lb.? *Ans.* £0 . 3 . 1.

21. If 24 yds. of cloth cost £7 . 11 . 6; how much is it per yard?

	£.	s.	d.	£.	s.	d.		s.	d.
24)	7	11	6(	0	6	$3\frac{3}{4}$ *Ans.*		6	$3\frac{3}{4}$
	20								6
	151(6s.							£1 . 17 .	$10\frac{1}{2}$
	144								4
	7						Proof,	£7 . 11 .	6
	12								
	90(3d.								
	72								
	18								
	4								
	72(3 qrs.								
	72								

NOTE.—To prove the work, I multiply the price of one yard, first by 6, and that product by 4; because 4 times 6 is 24.

22. If 35 bushels of wheat cost £12 . 14 . $5\frac{3}{4}$; how much is it per bushel? *Ans.* £0 . 7 . $3\frac{1}{4}$.

23. If 84 gallons of gin cost £23 . 12 . 6; what is it per gallon? *Ans.* £0 . 5 . $7\frac{1}{2}$.

24. If 68 yards of cloth cost £76 . 11 . 5; how much is it per yard? *Ans.* £1 . 2 . $6\frac{1}{4}$.

25. If $67\frac{1}{2}$ yds. of cloth cost £54 . 18 . 3 . $1\frac{1}{2}$; how much is it per yard?

Yd.	£.	s.	d.	qr.			
$67\frac{1}{2}$)	54	18	3	$1\frac{1}{2}$			
2				2			
					£.	s.	d.
135)	109	16	6	3(	0	16	$3\frac{1}{4}$ *Ans.*

20

2196(16s.
135

846
810

36
12

438(3d.
405

33
4

135(1 qr.
135

Note 1.—I multiply the 67 by 2, and add in the 1 half, to bring it into halves, or a whole number.

Note 2.—I multiply the price by 2, because I did the quantity,—then divide the product of the price, by the product of the quantity.

26. If 97 yds. of cloth cost £122 . 9 . 3; how much is it per yard? *Ans.* £1 . 5 . 3.

27. If I buy 100 barrels of flour for £227 . 10; how much did I pay for each barrel? *Ans.* £2 . 5 . 6.

28. If I pay £119 . 2, for 144 bushels of wheat; what did I pay per bushel? *Ans.* £0 . 16 . $6\frac{1}{2}$.

29. Suppose 165 yards of cloth cost £193 . 17 . 6; how much was it per yard? *Ans.* £1 . 3 . 6.

30. If $137\frac{1}{4}$ yards of cloth cost £25 . 6 . 1 . $1\frac{1}{4}$; how much is it per yard? *Ans.* 3s. $8\frac{1}{4}$d.

		£.	s.	d.			£.	s.	d.
31.	Divide	202	10	0	by 300.	*Ans.*	0	13	6
32.	Divide	70	11	$2\frac{1}{2}$	by $769\frac{3}{4}$.	*Ans.*		1	10
33.	Divide	2084	10	10	by 980.	*Ans.*	2	2	$6\frac{1}{2}$

34.—If 1 Cwt. of flour cost £2 . 2; how much is it per lb.?

Cwt.	£. s. £. s. d.
1	112)2 2(0 0 4½. *Ans.*
4	20
4	)42(0
28	12
112)	504(4d.
The pounds in a Cwt.	448
	56
	4
	224(2qr.
	224

NOTE.—I here reduce the weight to lbs., and the price to pence, I then find the dividend will contain the divisor 4 times, which is equal to 4d.; the 56 left, I multiply by 4 and divide again, and find there are 2 qrs.; the answer is therefore 4½d.

35. If 1 Cwt. of indigo cost £53 . 4; what is it per lb.? *Ans.* £0 . 9 . 6.

36. If 5 Cwt. of indigo cost £250 . 16 . 8; how much is it per lb.? *Ans.* 0 . 8 . 11½

37. If 5 Cwt. 3qr. 19lb. of sugar cost £37 . 5 . 10½; what is it per lb.? *Ans.* £0 . 1 . 1½.

38. If 8 Cwt. 2qr. of rice cost £19 . 16 . 8; how much is it per lb.? *Ans.* £0 . 0 . 5.

	£.	s.	d.				£.	s.	d.
39. Divide	405	6	8	by	512.	*Ans.*	0	15	10.
40. Divide	275			by	1000.	*Ans.*		5	6.

EXAMPLES.

Case 3.—*Where the quantity exceeds* 12, *and is a composite number.*

1. If 16 yards of cloth cost £21 . 8 . 0; how much is it per yard?*

£.	s.	d.
4)21	8	0
4) 5	7	0
£1 .	6 .	9 *Ans.*

NOTE.—I here divide the given sum by 4, and that quotient by 4; because 4 times 4 is equal to 16.

* This and the following sums, prove Case 4th, in Compound Multiplication.

2. If 18 yards of cloth cost £24 . [illegible] 9; how much is it per yard? *Ans.* £1 . 7 . 2½.

	£.	s.	d.			£.	s.	d.
3. Divide	3	17	1	by 25.	*Ans.*	0 .	3 .	1.
4. Divide	9	1	5	by 28.	*Ans.*	0 .	6 .	5¾.
5. Divide	55			by 33.	*Ans.*	1 .	13 .	4.
6. Divide	27	4	6	by 44.	*Ans.*	0 .	12 .	4½.

7. If 96 gallons of brandy cost £56 . 8; how much is it per gallon? *Ans.* £0 . 11 . 9.

8. If 121 yards of cloth cost £140 . 18 . 3½; how much is it per yard? *Ans.* £1 . 3 . 3½.

9. Suppose 144 yards of cloth cost £174; how much was it per yard? *Ans.* £1 . 4 . 2.

EXAMPLES.

Case 4.—*Of weights and measures.*

1. If 2 silver cups weigh 1 lb. 7 oz. 5 pwt. and 4 gr.; what is the weight of each?*

	lb.	oz.	pwt.	gr.
2)	1	7	5	4
		9 .	12 .	14 *Ans.*

NOTE.—As the divisor is not contained in the 1 lb., I reduce it to ounces, adding in the 7 ounces, &c.

2. If 1 doz. silver spoons weigh 3lb. 3oz. 12pwt.; what is the weight of each? *Ans.* 3oz. 6pwt.

3. If 7 tierces of rice weigh 39cwt. 2qr.; how much does each tierce weigh? *Ans.* 5cwt. 2qr. 16lb.

4. If 4 packages of medicine weigh 13℔. 7℥. 2ʒ. 1℈. 4gr.; what is the weight of each package?

Ans. 3℔. 4℥. 6ʒ. 1℈. 16gr.

5. In 927 yards of cloth; how many pieces, each containing 25 yds. 3 qrs.? *Ans.* 36 pieces.

6. If a man travel 122 miles, 4 furlongs, and 20 poles, in 5 days; how far did he travel each day?

Ans. 24mi. 4fur. 4 rods.

* This and the following sums, prove Case 5th, in Compound Multiplication.

7. If 9 fields contain 113 acres, 3 roods, and 25 poles; how much land is there in each field?

Ans. 12A. 2R. 25pol.

8. If a wall which is 10 feet high, and 4 feet thick, contains 1200 solid feet; what is the length of it?

Ans. 30 feet.

NOTE.—Multiply the heighth by the thickness, divide the solid feet by that product, and the quotient will be the length.

9. If 25 hhds. contain 1534 gal. 1 qt. and 1 pt. of brandy; how much is there in each hogshead?

Ans. 61 gal. 1 qt. 1 pt.

10. If 7 casks of beer contain 5 butts, 1 hhd. 27 gal. 1 qt.; how much is there in each cask?

Ans. 1 hhd. 34 gal. 3 qt.

11. If 8 bags contain 23 bushels of wheat; how much is there in each bag? *Ans.* 2 bus. 3 pk. 1 gal.

12. If a man do 114 hours, 45 minutes work, in 9 days; how long did he work each day? *Ans.* 12 h. 45 m.

13. If a vessel sail 25 deg. 42 m. and 40 s. in 10 days; how far did she sail each day? *Ans.* 2 deg. 34m. 16s.

EXAMPLES.

Case 5.—*Where the shares of partners are equal.*

1. If a man divide \$7500 equally among 5 children; what is the share of each?

\$
Number of children, 5)7500 Sum to be divided.

The share of each, \$1500 *Answer.*

2. If a man leave to his widow and two children, £450 . 18 . 6; what is the share of each?

Ans. £150 . 6 . 2.

3. Divide \$1000 equally among 15 persons.

Ans. \$66 . 66 . 6⅔, the share of each.

4. Divide an estate worth \$4260 . 75, equally between a widow, two sons, and five daughters, and tell me the share of each. *Ans.* \$532 . 59⅜.

EXAMPLES.

Case 6.—*Where the shares of partners are unequal.*

1. A prize worth £963 . 18, is to be divided in the following manner, viz., to the captain is given one third, the remainder is divided equally among 6 sailors; what is the share of each?

No. of Capt.'s shares. 3)963 18 £. s.

Ans. £321 . 6 { Capt's share.

	£.	s.	
	963	18	
Deduct	321	6	the Capt.'s share.
No. of Sailors	6)642	12	Is what remains after the Captain's share is deducted.
Ans.	£107 .	2	Each sailor's share.

To prove the work, multiply by 6, the No. of sailors.

Share of all the sailors,	£642 . 12	Which add together.
Captain's share,	321 . 6	
The whole sum to be divided was,	£963 18	Proof.

NOTE.—Here I first divide the given sum by 3, to find the captain's share: I then subtract the captain's share from the whole amount, and divide the remaining £642 . 12 by 6, and find a sailor's share to be £107 . 2.

2. Divide $1008, among 3 men, 3 women, and 3 boys; give each man double to a woman, and each woman double to a boy.

M. W. B.
3+3+3
2
=9 Women.
2
=21 { Boys, or No. of simple shares.

21)1008(48 dolls. a boy's share, which I double for a woman's share, and double that product for a man's share.
84
168
168

Ans. { $ 48 a boy's share.
$ 96 a woman's share.
$192 a man's share.

3. Divide \$180 among three persons, A, B, and C; give B twice as much as A, and C three times as much as B.

A. 1 share.
B. 2 shares.
C. 6 shares.

9 whole number of shares.

Ans. \$ 20 A's, share. \$ 40 B's, share. \$120 C's, share.

4. Divide £1110 between D, E, and F; give E ten times as much as D, and F ten times as much as E, what will each have?

Ans. £ 10 D's, share. £ 100 E's, share. £1000 F's, share.

5. Divide \$3515 between A, B, C, and D; give B three times as much as A; C four times as much as B, and D five times as much as C.

Ans. \$ 46 . 25 A's, 138 . 75 B's, 555 C's, 2775 D's, share.

6. A privateer takes a prize worth \$12465, which is divided in the following manner, viz.—the owners take one half, the officers one fourth, and the remainder is divided equally among 125 sailors; what is each sailor's share? *Ans.* \$24 . 93.

7. If \$70 is divided among an equal number of men, women and children, in such a manner, that a man receives \$2, a woman \$1, and a child 50 cents; how many were there of each sort? *Ans.* 20.

SUPPLEMENT TO PART FIRST.

EXERCISES IN THE FOREGOING RULES.

1. If Washington, the first President of the United States, was born A. D. 1732, and lived 67 years what year was it when he died? *Ans.* 1799.

2. From a pile of boards containing 10002 feet, I sold 1404 feet; how many feet had I left? *Ans.* 8598.

3. If a man brought me seventeen loads of brick, and each load contained four hundred and ninety-six; for how many brick must I pay him? *Ans.* 8432.

4. A gentleman left to be divided equally among 22 heirs, 8514 acres of land; what was the share of each? *Ans.* 387 acres.

5. If a merchant has goods to the amount of \$3704 . 10, and debts due him as follows, viz.—from A. \$100 . 10 . 9½, from B. \$96 . 08, and from C. \$18 . 67 . 1; how much is he worth? *Ans.* \$3918 . 96 . 0½.

6. A broker lent a merchant at one time, twenty thousand and ninety pounds, two shillings and eleven pence; at another, three thousand seven hundred and four pounds, ten shillings; and at another time, one hundred pounds, ten pence, one farthing: of which the merchant paid him at one time, ten thousand pounds, at another, six thousand, at another, one thousand, and at another time, six hundred and sixteen pounds; how much is he still indebted to the broker? *Ans.* £6278 . 13 . 9¼.

7. Suppose a farmer had three pieces of land; the first piece containing 27 acres, 2 roods, 25 poles; the second, 21 acres, 3 roods, 19 poles; the third, 37 acres, 2 roods, 29 poles: of which he should sell at one time, 10 acres, 1 rood; at another, 3 acres, 19 poles; and at another time, 2 acres, 1 rood, 20 poles; how many acres has he left? *Ans.* 71A. 1R. 34 poles.

8. In 20144 farthings; how many guineas at 28s. each? *Ans.* 14g. 27s. 8d.

9. If a merchant had \$1000 in cash, and sold them to a Broker in New-York at 8s. 8d. each; how much New York currency did he receive? *Ans.* £433 . 6 . 8.

10. How much silver in 38 spoons, each weighing 1oz. 3pwt. 16grs.? *Ans.* 3lb. 8oz. 19pwt. 8grs.

11. Divide \$1500 among so many, that each person's share will be \$60; and tell me how many partners there are. *Ans.* 25.

12. What number is that, to which if 20 be added; from that sum 70 be subtracted; the remainder multiplied

by 10; that product divided by 20; the quotient will be just 100? *Ans.* 250.

NOTE.—Set down the 100, and work from that number right to the reverse of the directions in the question.

13. What number is that, which if multiplied by 20, that product divided by 10, to the quotient 70 be added, from that sum 20 be subtracted; the remainder will be just 250? *Ans.* 100.

14. Bo't	2½ yds. of	Broadcloth at	\$7 . 50,	\$18 . 75.
	3 „	Cassimere	4 . 25,	12 . 75.
	¾ „	Silk Vesting	6	4 . 50.
	1½ „	Linen	67,	1 . 00½.
	1 Doz.	Buttons	1,	1.
	¾ „	do.	50,	37½.

What came they to? *Ans.* \$38 . 38.

15. Sold	1½ gal. Port Wine at	9s. 6d.	£0 : 14 . 3
	7¼ lb. Loaf Sugar	1 . 7	
	6 lb. Brown do.	11	
	½ lb. Young Hyson tea	8 . 3	
	4 lb. Coffee	1 . 7½	

How much must I receive for those goods? *An.* £2 . 1 . 10¼

16. I sent a boy to market with a bank note of \$2. Note, \$2 . 00

He bought 6 lb. of beef, at 9 cts. a pound, 0 . 54
3½ lb. of lamb, at 8 cts. a pound,
1 peck of pease, at \$1 . 20 a bushel,
and 2 bunches of onions, at 3 cts. a bunch,

Amount bought, \$

How much money had he left? *Ans.* \$0 . 82

17. A young lady went a shopping; and took with her a bank note of \$20. Note, \$20 00

She bought	$4\frac{3}{4}$ yds. Gingham,	at	\$ 0 44		2 09
	$\frac{1}{2}$ ps. Crape,	„	10 50		
	6 yds. Ribbon,	„	15		
	$1\frac{1}{2}$ „ Lace,	„	56		
	$\frac{1}{2}$ „ „	„	75		
	2 pr. Gloves,	„	28		
	1 pr. Shoes,	„	1 25		
			Amount bought,		\$

How much money had she left? *Ans.* \$8 . $73\frac{1}{2}$

New-York, 4*th July*, 1818.

18. Mrs. Levett,

Bo't of Loring & Smith.

$7\frac{1}{2}$ yds Calico,	at	3s. 4d.	£.
5 „ Gingham,	„	2 . 9	
$6\frac{1}{4}$ „ Flannel,	„	5 . 6	
2 oz. Thread,	„	1	
1 paper Pins,	„	9	
2 ps. Tape,	„	$10\frac{1}{2}$	

Rec'd payment, £3 . 17 . $7\frac{1}{2}$

for *Loring & Smith.*

Thomas Porter.

Note.—Finish this bill, and see if it is right.

☞ For *Necessary Forms*, of Notes, Orders, Receipts, Bills of Parcels, Drafts, Bills of Exchange, Book Account, Account Current, Invoice, &c. see Supplement to Part Second.

ARITHMETIC SIMPLIFIED.

PART SECOND.

PROPORTION.

PROPORTION, is the comparative relation of one thing to another; as Ratio, Symmetry, Form, Size, &c.

DIRECT PROPORTION,

OR

SINGLE RULE OF THREE DIRECT,

Teaches by having three numbers given, to find a fourth; which must bear the same proportion to the third, as the second does to the first.

If *more* require *more*, or *less* require *less*; the question belongs to the *Rule of Three Direct.*

More requiring *more*; is when the third term is greater than the first, and requires the fourth term, (or answer,) to be greater than the second.

Less requiring *less*; is when the third term is less than the first, and requires the fourth term, (or answer,) to be less than the second.

NOTE.—The *first* and *second* terms, are called *suppositions*; the *third*, a *demand*.

RULE.

State the question, by making that number which asks the question, the third term; or putting it in the third place.

That number which is of the same name or quality as the demand, the first term:

That number which is of the same name or quality with the answer required, the second term.

If the first and third terms, (or either of them,) are composed of different denominations, reduce them to the lowest denomination mentioned.

The second term, (if composed of different denominations,) must also be reduced to its lowest denomination.

The Terms being prepared;

Multiply the second and third terms together; divide the product by the first, and the quotient will be the answer to the question, in the same denomination the second term was left in; which may be brought into any other denomination required.

Should there be a remainder after dividing, reduce it to the next lower denomination, and divide as before.

Proceed thus with all the remainders, to the lowest denomination which the second term admits of; and the several quotients will be the answer required.

If the first term be greater than the product of the second and third; reduce the second to the next lower denomination, &c.

NOTE 1.—The number which asks or moves the question; has generally some words like these before it; viz.—What will? What cost? How much? How far? How many? How long? &c.

NOTE 2.—The proportion between the terms in the Single Rule of Three, is expressed thus; Viz.—

As the first term is to the second, so is the third to the fourth term, or answer required;

Or, as 4 is to 8 so is 8 to 16.
Or, as 6 : 12 :: 9 : 18.

NOTE 3.—As the idea annexed to the term Proportion, is easily conceived, it would be more perplexing than instructive to explain, in this place what is meant by it, in a strict *Geometrical* sense.

The *Rule* is applied to ordinary inquiries; it has been shewn in *Compound Multiplication*, that the price of one multiplied by the quantity, is the price of the whole: and in *Division*, that the price of the whole divided by the quantity, is the price of one. In this *Rule* it will be more fully shewn, that the magnitude or quantity of any effect, varies in proportion to the varying part of the cause; thus,—the quantity of goods bought, is in proportion to the money laid out; the space gone over is in proportion to the time, &c.

ILLUSTRATION.

If 1 yd. cost $3, then 4 yds. would cost $12.

But if 2 yds. cost only $3, then 4 yds. would cost but $6.

Here the cause is varied, from 1 to 2 yards; the quantity is thereby varied from 12 to 6 dollars.

It is therefore evident, (let the first term be any number whatever,) that the product of the second and third terms will exceed

the answer required, as much as the price in the second term exceeds the price of one; or as the first term exceeds an unit. Consequently this product divided by the first term will give the true answer required; and establishes the *Rule of Three.*

PROOF.

Invert the order of the question, and say;—as the fourth term (or answer,) is to the third, so is the second, to the first.

NOTE.—I have endeavoured in the foregoing observations, and following examples to make the method of work in this Rule, as easy and intelligible to the learner as possible.

QUESTIONS.

What is Proportion?
What does Direct Proportion, or single rule of three direct, teach?
How can we tell when a question belongs to the rule of three direct?
What is meant by more requiring more?
What is meant by less requiring less?
What is the rule for stating a question?
Should either of the terms be composed of different denominations; what is to be done with them?
After the terms are prepared; how do we proceed?
Suppose there should be a remainder left after dividing; what is to be done with it?
If the first term should be greater than the product of the second and third; what is then to be done?
How can we determine which number asks the question?
How is the proportion between the terms, expressed?
What is the method of proof?

EXAMPLES.

1. If 4 yds. of cloth cost $8; what will 16 yds. cost at that rate?

1st term.		2d term.		3d term.
Yds.		$		Yds.
4	:	8	: :	16
				8

The above statement reads thus—
As 4 is to 8; so is 16, to 32: the answer.—Or
As 4 yards is to 8 dollars, so is 16 yards to 32 dollars; the answer.

```
   16
    8
  ----
4)128(32 dol. Ans.
  12
  ---
    8
    8
```

NOTE.—In this example, it is supposed that 4 yards of cloth cost 8 dollars; inquiry is then made, to find what 16 yards will cost in that proportion.

It is evident therefore, that the 16yds. is the number which moves, or asks the question; it consequently belongs in the third place, and is put for the third term.

The 4 yards being of the same name as the demand; are placed for the first term.

The 8 dollars being of the same name, with the answer required; are placed for the second, or middle term.

The terms being all whole numbers; I multiply the second and third terms together, and divide the product by the first; the quotient is the answer to the question.

For, as 8 dollars, is double to the 4 yards; so is 32 dollars, the answer, double to the 16 yards.

Again.

2. If \$32 buy 16 yds. of cloth; how many yds. will \$8 buy?

```
 $  Yds.  $
32 : 16 :: 8
           8
   ----
32)128(4 yds. Ans.
   128
   ----
```

Again.

3. If \$8 buy 4 yds of cloth; how much will \$32 buy?

```
$ Yds.  $
8 : 4 :: 32
          4
        ----
       8)128
        ----
   Ans. 16 yds.
```

Again.

4. If \$32 buy 16 yds. of cloth; how much will 4 yds. of the same cloth cost?

```
Yds.  $   Yds.
 16 : 32 :: 4
       4
     ----
  16)128(8 dol. Ans.
     128
     ----
```

NOTE 1.—The four first examples, by varying the order of the questions, are a proof to each other. They also show, how any question in this rule may be inverted.

NOTE 2.—Every two following questions prove each other.

5. If \$1.50, buy 6 lb. of coffee; how much will \$7.50 buy at that rate?

1st term.		2d term.		3d term.	
Cents.		lb.		Cents.	
150	:	6	::	750	: 30 lb. *Ans.*

6. If $7 . 50 buy 30 lb. of coffee; how much will 6 lb. of the same coffee cost? *Ans.* $1 . 50.

Note.—This proves the preceding question.

7. Suppose 30 lb. of sugar to be worth £2 . 5; how much of the same sugar may I have for 9s.?

```
 l. s.  lb.     s.
 2  5 : 30 : :  9
20         9
---       ---
45  45)270(6lbs. Ans.
       270
       ---
```

Note.—In this example there are two denominations in the first term, I therefore reduce it to shillings, the lowest denomination mentioned; and then proceed as in the first example.

8. Suppose 6lb. of sugar to cost 9s.; what will 30lb. of the same sugar cost? *Ans.* £2 . 5.

9. If 48 dollars buy 32lb. of tea; what will 8lb. of the same tea cost?

```
1st term.  2d term.  3d term.
   lb.        $         lb.
   32    :   48   : :   8
              8
            ---
       32)384(12 dol. Ans.
          32
          ---
           64
           64
```

Note.—This statement reads thus:—as 32lb. is to $48, so is 8 lb. to $12, the answer.

10. If 8lb. of tea cost $12; what will 32lb. cost? *Ans.* $48.

11. If £18 buy 20 yds. of cloth; what will 5 yds. of the same cloth cost?

```
Yd.    £      Yd.
20  :  18  : :  5
        5
      ---
   20)90(4£. 10s. Ans.
      80
      ---
      10
      20
      ---
  20)200(10s.
     20
     ---
      0
```

Note.—After multiplying, and dividing for pounds, there are 10 left; which I multiply by 20, and divide the product for shillings.

12. If 5 yds. of cloth cost £4 . 10; what will 20 yds. cost at that rate? *Ans.* £18.

13. If 72lb. of indigo cost £71 . 8; what will 9lb. cost?

lb.		£	s.		lb.		£	s.	d.	
72	:	71	8	::	9	:	8	18	6	*Ans.*

14. If £8 . 18 . 6 buy 9lb. of indigo; how much may I have for £71 . 8?

1st term.		2d term.		3d term.
£ s. d.		lb.		£ s.
8 18 6	:	9	::	71 8
20				20
178				1428
12				12
2142d.				17136 d.
				9

2142)154224(72 lbs. *Ans.*
14994

4284
4284

NOTE.—The first and third terms being of different denominations; I reduce them to the lowest denomination mentioned in the first; which is pence.

The statement then reads thus—as 2142d. is to 9lbs., so is 17136 pence to 72lbs., the answer.

15. If 12 yds. of cloth cost $3; how much will 6 yds. cost? *Ans.* $1 . 50.

16. If $1 . 50 buy 6 yds. of cloth; how much must I give for 12 yds.? *Ans.* $3.

17. If $100 buy 12 acres of land; how many acres will $25 buy? *Ans.* 3 Acres.

18. If 3 acres of land cost $25; how many acres can I purchase with $100? *Ans.* 12 Acres.

19. If a man can earn $64 in 4 months; how long must he work to earn $304? *Ans.* 19 months.

20. If a man receive $304 for 19 month's work; how much will he receive for 4 months? *Ans.* $64.

21. If 1Cwt. 2qr. 19lb. of cocoa, cost £3 . 19 . 6; what will 3Cwt. 1qr. 10lb. cost at that rate?

1st term.	2d term.	3d term.
Cwt. qr. lb.	£ s. d.	Cwt. qr. lb.
1 2 19 :	3 19 6 : :	3 1 10
4	20	4
6	79	13
28	12	28
187lb.	954d.	114
	374	26
	3816	347lb.
	6678	
	2862	

12 20 £ s.
187)356796(1908 (159 (7 19 *Ans.*
187 12 140
1697 70 19s.
1683 60
1496 108
1496 108

NOTE.—After reducing the several terms to their lowest denominations, the statement reads thus—as 187lb. is to 954d.; so is 374 lb. to 1908d., which I reduce to pounds; the answer therefore in its highest denominations, is £7 . 19.

22. If £7 . 19 buy 3Cwt. 1qr. 10lb. of cocoa; how much will 1Cwt. 2qr. 19lb. cost at that rate? *Ans.* £3 . 19 . 6.

23. If a staff which is 3 feet long, cast a shadow 9 feet; how high is a steeple, whose shadow at the same time measures 285 feet?

Shadow. Heighth. Shadow.
9 : 3 : : 285
3
9)855(95 feet *Ans.*
81
45
45

NOTE.—Here I say, as 9 feet shadow is to 3 ft. heighth, so is 285 ft. shadow to 95 feet heighth, the answer.

24. If a steeple 95 feet high, cast a shadow 285 feet; how long is a staff, whose shadow at the same time measures 9 feet? *Ans* 3 feet.

25. If a man's income be $1460 per annum; what is that per day?

Days.	$.		Day.
365 :	1460	::	1
	1		

NOTE.—Per annum is by the year.

365)1460(4 dol. *Ans.*
1460

26. If a man's income be $4 per day; how much is that per annum? *Ans.* $1460.

27. If $100 principal, gain $6 interest in a year; what interest will $475 principal gain in that time?

Principal.		Interest.		Principal.		Interest.
$		$		$		$ cts.
100	:	6	::	475	:	28 50 *Ans.*

28. If $475 principal, gain $28 . 50 interest in a year; how much interest will 100 dollars principal, gain in that time? *Ans.* $6.

29. If 2 Cwt. 1 qr. 14 lb. of sugar cost $30 . 04 . 3¾; how much is it per cwt.?

NOTE.—The first and third terms in this example, I reduce to lbs.; because the lowest denomination in the 1st term, is lbs. The middle term, I multiply by 4, and bring in the ¾ of a mill. The answer to the question is, therefore, 50600 quarter mills; which I divide by 4, to bring them into mills; the right hand figure of which I point off for mills; the two next for cents; the remaining left hand figures are dollars.

1st term.		2d term.		3d term.
Cwt. qr. lb.		mills.		Cwt.
2 1 14	:	30043¾	::	1
4		4		4
9		120175		4
28		112		28
266lbs.		240350		112lbs.
		120175		
		120175		

4)
266)13459600(50600
1330
———— $12.65.0
1596
1596
————
00

30. If 1cwt. of sugar cost $12 . 65; how much will 2 cwt. 1qr. 14lb. cost at that rate? *Ans.* $30 . 04 . 3$\frac{84}{112}$.

31. If 1cwt. of rice cost $4 . 25; what will 9cwt. 2qr. come to at that rate? *Ans.* $40 . 37 . 5.

32. If 9cwt. 2qrs. of rice cost $40 . 37 . 5; how much is it per cwt.? *Ans.* $4 . 25.

33. If 1 yard of crape cost $2 . 71 . 1$\frac{1}{5}$; how much will 67$\frac{1}{2}$ yards cost at that rate?

yd.		mills.		yds.		$. cts. m.
1	:	2711$\frac{1}{5}$	::	67$\frac{1}{2}$	:	183 04 6$\frac{1}{2}$
2		5		2		*Answer.*
2		13559		135		

NOTE 1.—The terms in the above statement are all reduced to their lowest denominations; the first and third to half yards; and the middle term to fifth of mills.

NOTE 2.—Now, multiply the second and third terms together; divide the product by the first, and the quotient will be fifth of mills; which divide by 5, and that quotient will be mills; then point off the several denominations as above, into dollars, cents and mills.

34. If 67$\frac{1}{2}$ yards of crape cost $183 . 04 . 6$\frac{1}{2}$; how much is that per yard? *Ans.* $2 . 71 . 1$\frac{1}{5}$.

35. If 1 cwt. of tobacco cost $8; how much will 1$\frac{1}{4}$ cwt. cost at that rate? *Ans.* $10.

36. If 1 cwt. 1 qr. of tobacco cost $10; what will 1 cwt. cost at that rate? *Ans.* $8.

37. If $12 buy 1 cwt. of tobacco; how much will $129 buy at that rate? *Ans.* 10 cwt. 3 qr.

38. If 10 cwt. 3 qr. of tobacco cost $129; how much will $12 buy? *Ans.* 1 cwt.

39. If a land tax of $4608 be laid on a town containing 23040 acr.; how many acres has A, whose land tax is $10?

Town Tax. $		Acres in the Town.		A's Tax. $		A's Land Acres,
4608	:	23040	::	10	:	50 *Ans.*

40. If a man who has 50 acres of land, be taxed $10: what would be the tax on a town containing 23040 acres? *Ans.* $4608.

41. If a man's income be £300 per annum; what is that per day? *Ans.* 16s. 5d. 1$\frac{15}{365}$ qr.

42. If a man's income be 16s. 5d. $1\frac{15}{365}$qr. per day? what is that per ann.?

```
Day.     s. d. qr.          Days.
 1  :   16  5 1 15/365  ::  365
        12
        ---
        197
          4
        ---
        789
        365
        ---
       3960
      4734
     2367
     ------
   4)288000
     ------
  12)72000
     -----
  2|0)600|0
     -----
     £300 Answer.
```

NOTE.—In this example, I reduce the middle term to farthings; and as the lower number of the fraction is just equal to the third term, I multiply by one of them only; and bring in the upper number of the fraction; the product is farthings, which I reduce to pounds; for dividing by 1, would not alter the product.

43. If a man receive 3s. 4d. per day; how much is that per annum? *Ans.* £60.16.8.

44. If a man receive £60.16.8 per annum; how much is that per day? *Ans.* 3s. 4d.

45. If 1 eagle, 2 dol. 8 dimes, 2 cents, and 5 mills buy 675 oranges; how many will 19 mills buy? *Ans.* 1 orange.

46. If 1 orange cost 19 mills; how many may I have for 1 eagle, 2 dol. 8 dimes, 2 cents, and 5 mills? *Ans.* 675 oranges.

47. If $\frac{4}{5}$* of a ship cost $12580; what is the whole ship worth?

Fifths.		\$.		Fifths.		\$.
4	:	12580	::	5	:	15725. *Ans.*

48. If a ship be worth $15725; how much is $\frac{4}{5}$ of her worth? *Ans.* $12580.

*As the ship is divided into 5 equal parts; 5-5 would comprize the whole: therefore 4 is the supposition, and 5 the demand.

49. What will 4 pipes of brandy containing, viz.—$79\frac{1}{2}$, 84, $101\frac{1}{2}$, and 112 gallons come to; at 6s 9d. per gallon?

Gal. : s. d. : : Gal.
1 : 6 9 : : $79\frac{1}{2}$
12 — 84
— $101\frac{1}{2}$
81d. 112

377gal.
81
377
3016
12)30537d.
2|0)254|4.9
Ans. £127.4.9

NOTE.—After the contents of the 4 pipes are added together, and the price of a gallon reduced to pence; the statement reads thus—
As 1 gal. is to 81d., so is 377 gals. to 30537d. or £127 . 4 . 9, the answer.

50. If 4 pipes of brandy containing, viz.—$79\frac{1}{2}$ 84, $101\frac{1}{2}$, and 112 gallons, cost £127.4.9; how much is it per gallon? *Ans.* 6s 9d.

51. If 1 yard of Linen cost 4s. 6d.; what is the value of 5 ps., each piece containing 12 yds.? *Ans.* £13.10.

52. If 5 pieces of Linen, each containing 12 yards, cost £13.10; how much is it per yard? *Ans.* 4s. 6d.

53. If a merchant bought 270 barrels of cider for \$780, and paid for freight \$37.70, duties, and other charges \$30.60; what must he sell it per barrel, to gain \$143?

bbl. : \$: : bbl.
270 : 780 : : 1
37.70 Freight.
30.60 Duties, &c.
848.30 Amount of cost.
143 The gain.
991.30 Amount of cost and gain.
1 Bbl.
\$. cts.
270)991.30(3 . $67\frac{40}{270}$ *Ans.*
810
1813
1620
1930
1890
40

NOTE.—Here the first cost of the cider, the freight, duties, &c., are added together; then the gain is added to the amount of cost; the whole amount of cost and gain therefore constitutes the middle term.

54. If a merchant buy 270 barrels of cider, for which he pays \$780; freight \$37.70; duties, &c. 30.60; and he sells it for \$3.67$\frac{40}{270}$ per barrel; how much does he gain by the bargain? *Ans.* \$143.

55. If I give £16.10 for a piece of cloth containing 22 yards; how much did it cost per yard? *Ans.* 15s.

56. If I buy a piece of cloth for £16.10, at 15s. per yard; how many yards did it contain? *Ans.* 22 yds.

57. If a man owes £2119.17.6, and his estate is worth but £1324.18.5¼; how much can he pay his creditors on the pound?

```
    Debt.                   Estate.                Debt.
  £      s.   d.       £      s.    d.              £
 2119    17   6   :   1324    18    5¼     ::       1
   20                   20                         20
 ------              ------                        --
 42397               26498                         20
    12                  12                         12
 ------              ------                        ---
 508770d.            317981                        240
                          4
                     --------
                     1271925qrs.
                         240
                     --------
                    50877000
                   2543850
                   --------- 4
         50877|0)30526200|0(600(
                 305262       ---
                 ------- 12)150
                      00    ---
                        12s. 6d. Ans.
```

NOTE.—After reducing the terms to their lowest denominations, I say: as so many pence is to so many farthings, so is so many pence to 600 farthings; which I then reduce to shillings.

58. If a man owes £2119.17.6, and pays but 12s. 6d. on the pound; how much does he pay in the whole? *Ans.* £1324.18.5¼.

59. If £100 New-England currency, be equal to £133.6.8 in New-York; how much New-York currency, is equal to £6 in New-England?

N.E. currency.		N.Y. currency.		N.E. currency.		N.Y. currency.
£.		£. s. d.		£.		£.
100	:	133 6 8	::	6	:	8 *Ans.*

60. If £100 New-England currency, be equal to £133.6.8, in New-York; how much New-England currency, is equal to £8 in New-York? *Ans.* £6.

61. If £6 New-England currency, be equal to £8 in New-York; how much New-England currency, is equal to £133.6.8 in New-York? *Ans.* £100.

62. If £8 New-York currency, be equal to £6 in New-England; how much New-York currency, is equal to £100 in New-England? *Ans.* £133.6.8.

INVERSE PROPORTION,

OR

SINGLE RULE OF THREE INVERSE,

Teaches by having three numbers given to find a fourth; which must bear the same proportion to the second, as the first does to the third.

If more require less, or less require more; the question belongs to the Rule of Three Inverse.

More requiring less, is when the third term is greater than the first; and requires the fourth term, (or answer) to be less than the second.

Less requiring more, is when the third term is less than the first; and requires the fourth term, (or answer) to be greater than the second.

RULE.

State, and reduce the terms, as in Direct Proportion.

Multiply the first, and second terms together;—divide the product by the third, and the quotient will be the answer, in the same denomination, the second term was left in; which may be brought into any other denomination required.

PROOF.

Invert the order of the question as observed in the Single Rule of Three Direct.

NOTE.—Each sum in this Rule is proved by the one next preceding or following.

QUESTIONS.

What does Inverse Proportion, or Single Rule of Three Inverse teach?

How can we determine when a question belongs to the Rule of Three Inverse?

What is meant by more requiring less?

What is meant by less requiring more?

How is a question to be stated in this rule?

After the question is stated, how do we proceed?

What is the method of Proof?

EXAMPLES.

1. If 8 men will do a piece of work in 24 days; in what time will 16 men do it?

1st term.		2d term.		3d term.
m.		d.		m.
8	:	24	: :	16

```
   24
    8
   ———
16)192(12d. Ans.
   16
   ———
    32
    32
   ———
```

Note 1.—I state this question as in Direct Proportion, and find that more requires less; for the 16 men are more than 8, and can do the work in less time.

Note 2.—After stating the question, I multiply the first and second terms together, then divide the product by the 3d; and find the product of the 3d, and 4th terms, or the number of days work performed by 16 men in 12 days; is just equal to the product of the first and second terms; or the number of days work performed by 8 men in 24 days.

Proof.

Prod. of 1st & 2d terms.		Prod. of 3d & 4th terms.
24		16
8		12
192	=	192

Again.

2. If 16 men can perform a piece of work in 12 days; in what time will 8 men do it? *Ans.* 24 days.

Again.

3. If 8 men can perform a piece of work in 24 days; how many men would it require to perform the same work in 12 days? *Ans.* 16 men.

Again.

4. If 16 men can perform a piece of work in 12 days; how many men would it require to do it in 24 days? *Ans.* 8 men.

Note.—The four first examples prove each other.

5. Suppose it is required to line 8 yds. of broadcloth, 1½ yds. wide; how much shalloon ¾ of a yd. wide, will be sufficient?

	Width. Yds.		Length. Yds.		Width. Yd.
	1½	:	8	::	¾
	4		6		
	6		3)48		
			Ans. 16yds.		

NOTE 1.—Here length is required, therefore length must be the 2d term.

NOTE 2.—Here the shalloon is narrower than the cloth, & the length must be greater.

NOTE 3.—I reduce the width of the cloth to quarters; and multiply the length by the width; or the 1st & 2d terms together,—then divide the product by the 3d term, or the width of the shalloon; and find that 16yds., ¾ in width; is just equal to 8yds., $\frac{6}{4}$, or 1½ yd. in width.

6. How much cloth 1½ yds. wide, will be sufficient to line 16yds., which is ¾ of a yd. wide? *Ans.* 8 yds.

NOTE.—This proves the preceding example.

7. Suppose I lend a friend $100 for 3 months; how long may I keep $75 of his money to balance the favor? *Ans.* 4 months.

8. Suppose I borrow $75 of my friend for 4 months; how much money must he retain of mine 3 months, to balance the favor? *Ans.* $100.

9. If a man perform a journey in 18 days, by travelling 15 hours in the day; how long would it take him to perform the same journey, should he travel only 12 hours per day? *Ans.* 22½ days.

10. If a man perform a journey in 22½ days, when the days are 12 hours long; how many days will it take him to perform the same journey, when the days are 15 hours long? *Ans.* 18 days.

11. How much in length, that is 6 inches wide, will make a square foot?

Width. Inch.		Length. Inches.		Width. Inches.
1	:	144	::	6
		1		
		6)144		
		12)24 inches.		
		2 feet. *Ans.*		

NOTE.—If 144 square inches, make a square foot; so, 1 inch in width, and 144 in length make a square foot.

12. How much in width, that is 2 feet in length; will make a square foot? *Ans.* 6 inches.

13. How many yds. of carpeting, that is 1 yd. wide; will cover a floor, that is 30 feet long, and 18 feet wide?

Width.		Length.		Width.
Ft.		Ft.		Yd.
18	:	30	::	1
		18		3
		240		3 feet.
		30		
		3)540		
		3)180 feet.		

Ans. 60 yards.

NOTE.—Here I multiply the 1 yd. by 3, because 3 feet make a yd. The statement then reads thus: as 18 ft. in width, is to 30 ft. in length, so is 3 feet in width, to 180 feet in length, or 60 yards, the answer.

14. If 60 yds. of carpeting, will cover a floor that is 30 feet long, and 18 broad; what is the width of the carpet? *Ans.* 3 ft., or 1 yd.

15. If a piece of land, be 20 rods in length; how wide must it be to contain an acre?

Length.		Width.		Length.		Width.
rods.		rod.		rods.		rods.
160	:	1	::	20	:	8 *Ans.*

16. If a piece of land, be 8 rods wide; what length, will make an acre? *Ans.* 20 rods.

COMPOUND PROPORTION,

OR

DOUBLE RULE OF THREE,

TEACHES to resolve such questions, as require two or more statings by Single Proportion;

It is generally composed of five numbers to find a sixth.

If the proportion is direct, the sixth number (or answer sought,) must bear such proportion to the fourth and fifth, as the third bears to the first and second.

If the proportion is inverse, the sixth number (or answer sought;) must bear such proportion to the fourth and fifth, as the first bears to the second and third.

NOTE.—The first, second, and third terms, are suppositions; the fourth, and fifth, demands.

RULE.

State the question, by placing that number which is the principal cause of gain, loss, or action, in the first place; or for the first term;

That number which denotes the space of time, or distance of place, the second;

That number which is the gain, loss or action, the third;

Place the other two terms which move the question, under those of the same name;

If the blank place, or term sought, fall under the third term, the question is Direct Proportion.

If the blank place, or term sought, fall under the first, or second term, the question is Inverse Proportion.

When the Proportion is Direct.

Multiply the third, fourth, and fifth terms together for a dividend; and the first and second for a divisor, and the quotient will be the answer to the question, in the same name of that term under which the blank falls.

NOTE.—The question arises wherever the blank falls.

When the Proportion is Inverse,

Multiply the first, second, and fifth terms together for a dividend, and the third and fourth for a divisor; and the quotient will be the answer.

NOTE.—Should either of the five terms be a compound number, it must be reduced to the lowest denomination mentioned, together with its correspondent term; and the answer will be in the same name as the one over which the blank falls.

PROOF.

Invert the order of the question; or,

Make two statings in Single Proportion.

NOTE.—Each sum is proved by the one next preceding or following it.

QUESTIONS.

What does Compound Proportion, or the Double Rule of Three teach?

How many given numbers, or terms are there in Compound Proportion?

If the question is direct; what proportion does the sixth term, or answer, bear to the rest?

If the question is inverse; what proportion does the answer bear to the given terms?

Which of the terms are suppositions?

Which of the terms are demands?

What is the rule for stating a question in Compound Proportion?

Where does the question arise?

If the Proportion is direct; how do we proceed?

If the Proportion is inverse; what is the method of work?

How do we know whether the question is direct or inverse?

Which of the given terms, is the answer like?

How do we prove Compound Proportion?

EXAMPLES.

1. If $100 principal, gain $6 interest in a year, (or 12 months;) what will $450 gain in 16 months?

Cause of gain.		Space of time.		Gain.
$		mo.		$
100	:	12	::	6
450		16		

```
              16
               6
             ---
              96
             450
            ----
     100    4800
      12     384
    ----    ----  $
    1200 )43200(36 Ans.
           3600
           ----
            7200
            7200
            ----
```

NOTE 1.—I state this question by saying, If $100 in 12 mo. gain $6, how much will $450 gain in 16 mo.

NOTE 2.—Here the blank falls under the third term; the proportion is therefore direct

NOTE 3.—The proportion being direct, I multiply the three last terms together for a dividend, and the two first for a divisor; and the quotient is the answer.

Again.

2. If $100 gain $6 in a year; in what time will $450 gain $36?

Cause of gain.		Space of time.		Gain.
$		mo.		$
100	:	12	::	6
450	:		::	36
				12

NOTE 1.—Here the blank falls under the second term; the proportion is therefore inverse.

NOTE 2.—The proportion being inverse, I multiply the first, second, and last terms together for a dividend, and the other two for a divisor; and the quotient is the answer.

450	432
6	100
	mo.
2700)	43200(16 *Ans.*
	2700
	16200
	16200

Again.

3. If $100 principal, gain $6 in a year; what principal will gain $36 in 16 months?

NOTE.—Here the proportion is inverse.

Cau. of gain.		Spa. of time.		Gain.	
$		mo.		$	
100	:	12	::	6	*Ans.*
		16	::	36=$450	

4. If $450 principal, gain $36 interest in 16 months; what is the rate per cent. per annum?

NOTE.—Per cent. is by the hundred.—Per annum is by the year.

NOTE.—Here the proportion is direct.

Cau. of gain.		Spa. of time.	Gain.	
$		mo.	$	
450	:	16	36	*Ans.*
100	:	12		=$6

Again.

5. If $450, gain $36 in 16 months; in what time will $100, gain $6?

NOTE.—Here the proportion is inverse.

Cau. of gain.		Spa. of time.		Gain.	
$		mo.		$	
450	:	16	::	36	mo.
100	:		::	6=12 *Ans.*	

Again.

6. If $450 principal, gain $36 in 16 months; what principal, will gain $6 in 12 months?

	Cause of gain.		Space of time.		Gain.	
	$		mo.		$	
NOTE 1.—Here the proportion is inverse.	450	:	16	::	36	*Ans.*
			12	::	6=$100.	

NOTE 2.—The 6 preceding examples, by varying the order of the questions, prove each other; and shew how any question in this rule may be changed.

7. If 20 men in 5 days, can reap 100 acres of grain; how many acres can 7 men reap in 12 days?

	Cause.		Time.		Gain.
	Men.		Days.		Acres.
NOTE.—Here the proportion is direct.	20	:	5	::	100 acres.
	7	:	12	::	=84 *Ans.*

8. If 7 men in 12 days, can reap 84 acres; how many acres, can 20 men reap in 5 days? *Ans.* 100 acres.

9. If 8 men in 16 days, can mow 128 acres of grass; in what time, will 4 men mow 48 acres? *Ans.* 12 days.

10. If 4 men in 12 days, mow 48 acres; how many acres can 8 men mow in 16 days? *Ans.* 128 acres.

11. If a family of 14 persons, spend $1120 in 8 months how much would 9 of the same family spend, in 5 months? *Ans.* $450.

12. If a family of 9 persons, spend $450 in 5 months; how much would they spend in 8 months, if 5 more were added to the family? *Ans.* $1120.

13. If 24 men build a wall, 200 ft. long, 8 ft. high, and 6 ft. thick, in 80 days; in what time will 6 men build one, 20 ft. long, 6 ft. high, and 4 ft. thick?

$200\times8\times6$ $\qquad$ $20\times6\times4$

200×8×6	20×6×4
8	6
1600	120
6	4
9600 } Feet of wall that was built.	480 } Feet of wall to build.

Statement.

Cau. of gain.		Spa. of time.		Gain.	
Men.		Days.		Feet.	
24	:	80	::	9600	*Ans.*
6	:		::	480=16 da.	

14. If 6 men build a wall, 20 ft. long, 6 ft. high, and 4 ft. thick, in 16 days; in what time will 24 men build one, 200 ft. long, 8 ft. high, and 6 ft. thick? *Ans.* 80 days.

15. If the freight of 10 hhds. of sugar, each weighing 12 cwt., 50 miles, cost \$12; what must be paid for the freight of 40 tierces ditto, each weighing $3\frac{1}{2}$ cwt. 150 miles?

Each hhd.	12 cwt.	Each tierce	$3\frac{1}{2}$ cwt.
	10 hhds.		40 tierces.
	120 wt. of 10 hhds.		$20=\frac{1}{2}$ of 40.
			120
			140 wt. of 40 tier.

Cause of loss.		Distance of place.		Loss.
Cwt.		Miles.		\$
120	:	50	:	12
140	:	150	:	=\$42 *Ans.*

16. If the freight of 40 tierces of sugar, each weighing $3\frac{1}{2}$ cwt. 150 miles, cost \$42; what must be paid for the freight of 10 hhds. ditto; each weighing 12 cwt., 50 miles?
Ans. \$12.

VULGAR FRACTIONS.

Vulgar Fractions, are parts of an unit, (or whole number;) and are expressed, (or represented) by two numbers, placed one above the other, with a line drawn between them, thus; $\frac{1}{2}$ one half; $\frac{3}{4}$ three fourths; $\frac{9}{10}$ nine tenths, &c.

The number above the line, is called the numerator.

The number below the line, is called the denominator.

The remainder left, after dividing any whole number, is the numerator of a fraction; and the divisor is the denominator?

The denominator shews, into how many parts the integer is divided; and the numerator shews, how many of those parts are meant by the fraction.

Vulgar Fractions are of four kinds, viz. proper, improper, compound and mixed.

A proper fraction, is when the numerator is less than the denominator; thus, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{4}{7}$, $\frac{9}{10}$, $\frac{17}{20}$, &c.

An improper fraction, is when the numerator is greater than the denominator; thus, $\frac{2}{1}$, $\frac{4}{3}$, $\frac{7}{5}$, $\frac{10}{9}$, $\frac{20}{17}$, &c.

A compound fraction, is the fraction of a fraction; or, two or more fractions connected together; thus, $\frac{1}{2}$, of $\frac{3}{4}$, one half of three fourths; or, $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$, two thirds of three fourths of five sixths, &c.

A mixed number, or fraction, is composed of a whole number, and fraction; thus, $7\frac{3}{4}$ seven and three fourths; $12\frac{1}{2}$, twelve and a half; $19\frac{7}{8}$, nineteen and seven eighths, &c.

NOTE.—Any whole number may be made, (or reduced to) an improper fraction, by considering it as a numerator, and placing 1 under it for a denominator; thus, $\frac{4}{1}$, four ones; $\frac{8}{1}$ eight ones; $\frac{10}{1}$ ten ones; $\frac{100}{1}$ one hundred ones, &c.; for 1, is equal to 2 halves, 3 thirds, 4 quarters, &c.

A fraction is in its lowest term, when it is expressed by the least numbers possible; as, $\frac{5}{15}$ is equal to $\frac{1}{3}$; $\frac{15}{20}$ is equal to $\frac{3}{4}$, &c.

Or,

$$\left.\begin{array}{l} \frac{5}{15} = \frac{1}{3}, \\ \frac{15}{20} = \frac{3}{4}, \end{array}\right\} \text{ their lowest terms.}$$

Aliquot is a even part of an integer.

As, 6 pence, is = $\frac{1}{2}$ of a shilling.
5 shillings, is = $\frac{1}{4}$ of a pound, &c.

NOTE.—If the numerator of a fraction should be increased, the value of the fraction would become greater; if the denominator is increased, the value becomes less. But when the numerator and denominator are both increased, or diminished, in the same proportion, the value is not altered; for the fractions thus obtained, would be of equal value.

REDUCTION OF VULGAR FRACTIONS.

Reduction of Vulgar Fractions, teaches to bring them out of one form into another, to prepare them for further operations.

Case 1.—*To reduce Vulgar Fractions to their lowest terms.*

RULE.

Divide the denominator of the fraction by the numerator, and if there be a remainder, divide the numerator by it:—thus continue to divide the last divisor, by the last remainder till nothing remain; then divide both the numerator, and denominator of the given fraction, by this last divisor; and their quotients, will shew the given fraction in its lowest terms.

NOTE.—The last divisor is called, the common measure.

Or,

Divide the numerator, and denominator, by any such number as will divide them both without a remainder; then divide the quotients again by the same, or any other number which will divide them without a remainder; thus continue to divide, until no number except one will divide them without a remainder; the fraction will then be in its lowest terms.

Case 2.—*To reduce vulgar fractions of different denominations, to equivalent fractions, having a common denominator.*

RULE.

Multiply the numerator of each fraction into all the denominators except its own, for a new numerator: and all the denominators into each other, for a common denominator.

Case 3.—*To reduce an improper fraction to a whole or mixed number.*

RULE.

Divide the numerator by the denominator; the quotient will be the whole number, and the remainder (if any) will be the numerator to the divisor, or, given denominator.

Case 4.—*To reduce a simple fraction to the known parts of the integer; as of Coin, Weight, Measure, &c.*

RULE.

Multiply the numerator by so many of the next inferior denomination, as make one, of which the fraction is a part; and divide the product by the denominator; if any thing remain, multiply the remainder by the next inferior denomination; divide that product by the denominator as before, and so on, (if there be a remainder,) through all the different denominations; and the several quotients will be the answer required.

ADDITION.

To add Simple Fractions, having one common denominator.

RULE.

Add all the numerators together, and divide their sum, by the donominator.

Set down the remainder, (if any) over the denominator, and carry the number of times the denominator was contained in the numerators, to the whole numbers.

SUBTRACTION.

To subtract Simple Fractions, having one common denominator.

RULE.

When the lower fraction is less than the upper,

Subtract the lower numerator from the upper, and set down the remainder over the common denominator.

When the lower fraction is greater than the upper.

Subtract the lower numerator from the denominator; add the remainder to the upper numerator; which sum place over the denominator, and carry one to the whole numbers for the fraction borrowed.

When the minuend has a fraction, and the subtrahend none.

Bring down the fraction of the minuend into the remainder; then proceed with the other figures as if there had been no fraction.

When the subtrahend has a fraction, and the minuend none.

Subtract the numerator from the denominator, and place the difference over the denominator; then carry one to the whole numbers, for the fraction borrowed.

MULTIPLICATION.

Case 1.—*To multiply whole numbers by a simple fraction.*

RULE.

Multiply the whole numbers by the numerator, divide the product by the denominator—and the quotient will be the answer.

NOTE 1.—If the numerator be 1, divide by the denominator only, (as 1 will not multiply,) and the quotient will be the true product or answer.

NOTE 2—The product of any number, when multiplied by a fraction only, will be less than the multiplicand, in the same proportion, as the multiplier is less than 1.

Case 2.—*When the multiplier is a mixed number.*

RULE.

Multiply the multiplicand by the numerator of the fraction, and divide the product by the denominator; then multiply the multiplicand by the whole number of the multiplier; add the product of the whole number, and the quotient of the fraction together; and their sum will be the total product or answer.

Case 3.—*When the multiplicand is a mixed number.*

RULE.

Multiply the multiplier by the numerator of the fraction; and divide the product by the denominator; then multiply the whole numbers of the multiplicand by the multiplier; and the sum of the product, and quotient, will be the true product, or answer.

DIVISION.

Case 1.—*When the divisor is a fraction.*

RULE.

Divide the dividend, by the numerator of the fraction, and multiply the quotient by the denominator.

Or,

Multiply the dividend, by the denominator of the fraction, and divide the product by the numerator, and the quotient will be the answer.

NOTE 1.—If the numerator of the fraction be 1, multiply the dividend by the denominator only, (as 1 will not divide) and the product will be the true quotient.

NOTE 2.—If any number be divided by a fraction only, the quotient will be greater than the dividend, in the same proportion, as one is greater than the divisor.

Case 2.—*When the divisor is a mixed number.*

RULE.

Multiply its whole number by the denominator of the fraction; add to the product the numerator, for a new divisor; multiply the dividend also, by the denominator, for a new dividend; divide this new dividend, by the new divisor; and the quotient will be the true answer.

Case 3.—*When the dividend is a mixed number.*

RULE.

Multiply the dividend by the denominator of the fraction, and add to the product the numerator of the fraction, for a new dividend.

Multiply the divisor also by the denominator of the fraction for a new divisor.

Divide the new dividend by this new divisor, and the quotient will be the true answer to the question.

QUESTIONS.

What are Vulgar Fractions? Which number is the numerator? Which number is the denominator?
How many kinds of Vulgar Fractions are there?
What is a proper fraction? What is an improper fraction?
What is a compound fraction? What is a mixed number?
How may a whole number be reduced to an improper fraction?

When is a fraction said to be in its lowest terms?

What is meant by aliquot?

How is a Vulgar Fraction reduced to its lowest terms?

How are several fractions reduced to others of the same value; having one common denominator?

How is an improper fraction reduced to a whole, or mixed number?

How is a simple fraction reduced to the known parts of the integer?

How are simple fractions having one common denominator to be added?

How are simple fractions having one common denominator to be subtracted?

How is a whole number to be multiplied by a simple fraction?

How is a whole number to be multiplied by a mixed number?

How is a mixed number to be multiplied by a whole number?

How is a whole number to be divided by a simple fraction?

How is a whole number to be divided by a mixed number?

How is a mixed number to be divided by a whole number?

REDUCTION.

EXAMPLES.

Case 1.—*Where simple fractions are reduced to their lowest terms.*

1. Reduce $\frac{182}{392}$, to its lowest terms.

```
Nu'r. De'r.                          New
182)392(2                    Nu'r. Nu'r.
    364                        14)182(13 ┐
    ---                            14     │
     28)182(6                      --     │
        168                        42     │
        ---                        42     │
         14)28(2                   --     ├= 13/28 Ans.
            28                           New
            --                 De'r.  De'r.│
             0                 14)392(28  ┘
                                   28
                                   --
                                   112
                                   112
```

Note.—In the above example, I first divide the denominator of the fraction by the numerator; then divide the numerator by the first remainder; then divide the second divisor by the second remainder, and nothing remains; the last divisor, 14, is therefore the common measure of the given fraction.

I then divide the numerator of the given fraction by 14, and find a quotient of 13 for a new numerator.

I then divide the denominator of the given fraction by 14, and find a quotient of 28 for a new denominator.

Now the new numerator 13, and new denominator 28, or $\frac{13}{28}$ is the given fraction in its lowest terms.

Again.

Divisors, 7 2

Fraction, $\frac{182}{392}=\frac{26}{56}=\frac{13}{28}$ *Ans.*

NOTE.—Here I divide the given fraction first by 7; the quotients by 2; and find the given fraction in its lowest terms to be $\frac{13}{28}$, agreeable to the first operation.

2. Reduce $\frac{57}{456}$, to its lowest terms. *Ans.* $\frac{1}{8}$.
3. Reduce $\frac{171}{180}$, to its lowest terms. *Ans.* $\frac{19}{20}$.
4. Reduce $\frac{1428}{2856}$, to its lowest terms. *Ans.* $\frac{1}{2}$.
5. Reduce $\frac{164}{398}$, to its lowest terms. *Ans.* $\frac{82}{199}$.
6. Reduce $\frac{114}{285}$, to its lowest terms. *Ans.* $\frac{2}{5}$.
7. Reduce $\frac{3619}{5251}$, to its lowest terms. *Ans.* $\frac{11}{15}$.
8. Reduce $\frac{216}{288}$, to its lowest terms. *Ans.* $\frac{3}{4}$.
9. Reduce $\frac{468}{1184}$, to its lowest terms. *Ans.* $\frac{117}{296}$.
10. Reduce $\frac{1296}{3024}$, to its lowest terms. *Ans.* $\frac{3}{7}$.
11. Reduce $\frac{40}{160}$, to its lowest terms. *Ans.* $\frac{1}{4}$.
12. Reduce $\frac{10}{120}$, to its lowest terms. *Ans.* $\frac{1}{12}$.
13. Reduce $\frac{100}{1000}$, to its lowest terms. *Ans.* $\frac{1}{10}$.

Case 2.—*Where fractions of different denominators, are reduced to equivalent fractions, having one common denominator.*

1. Reduce $\frac{1}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$, to equivalent fractions, having a common denominator.

$\frac{1}{3}$, $\frac{3}{4}$, $\frac{4}{5}$	1st Nu'r.	2d Nu'r.	3d Nu'r.	Den'r.
	1	3	4	3
2d Denominator,	4	3	3	4
	4	9	12	12
3d Denominator,	5	5	4	5
Product,	20	45	48	60

Or,

$1\times4\times5=20$, the new numerator for $\frac{1}{3}$.
$3\times3\times5=45$, the new numerator for $\frac{3}{4}$.
$4\times3\times4=48$, the new numerator for $\frac{4}{5}$.
$3\times4\times5=60$, the common denominator.

The new equivalent fractions are therefore,

$\frac{20}{60}$, $\frac{45}{60}$, $\frac{48}{60}$, *Ans.*

Note.—In this example, I multiply the numerator of the first fraction, into the denominators of the other fractions, for a new numerator which is 20, for $\frac{1}{3}$.

I then multiply the numerator of the second fraction, into the denominators of the others, for a new numerator; which is 45 for $\frac{3}{4}$.

I then multiply the numerator of the third fraction, into the denominators of the others, for a new numerator; which is 48 for $\frac{4}{5}$.

I then multiply the denominators of the given fractions continually together, for a new denominator, which is 60; and find as stated before, that $\frac{1}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$, reduced to equivalent fractions, having a common denominator, are equal to $\frac{20}{60}$, $\frac{45}{60}$ and $\frac{48}{60}$.

2. Reduce $\frac{3}{4}$, $\frac{1}{2}$, and $\frac{11}{13}$, to fractions, having a common denominator. *Ans.* $\frac{78}{104}$, $\frac{52}{104}$, $\frac{88}{104}$.

3. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$, to fractions, having a common denominator. *Ans.* $\frac{576}{1152}$, $\frac{768}{1152}$, $\frac{864}{1152}$, $\frac{960}{1152}$, $\frac{1008}{1152}$.

4. Reduce $\frac{4}{9}$, $\frac{7}{12}$, $\frac{6}{7}$, and $\frac{1}{2}$; to a common denominator.
Ans. $\frac{672}{1512}$, $\frac{882}{1512}$, $\frac{1296}{1512}$, $\frac{756}{1512}$.

5. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{2}{8}$; to a common denominator.
Ans. $\frac{384}{480}$, $\frac{240}{480}$, $\frac{400}{480}$, $\frac{120}{480}$.
or, $\frac{192}{240}$, $\frac{120}{240}$, $\frac{200}{240}$, $\frac{60}{240}$, *Ans.*

Note.—Here the first answer would have been like the second, had the $\frac{2}{8}$ been placed $\frac{1}{4}$, its lowest terms. Still the first answer is equal in value to the second, and the second equal to the first.

6. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{9}$, and $\frac{6}{7}$; to a common denominator.
Ans. $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, $\frac{4320}{5040}$.

7. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{7}{8}$; to a common denominator.
Ans. $\frac{144}{288}$, $\frac{192}{288}$, $\frac{240}{288}$, $\frac{252}{288}$.

EXAMPLES.

Case 3.—*Where improper fractions are reduced to a whole, or mixed number.*

1. Reduce $\frac{49}{6}$, to a whole, or mixed number.

```
6)49(8⅙ Ans.
  48
  —
   1
```

NOTE.—Here I divide the numerator, by the denominator; the quotient 8, is the integer; and the remainder 1, together with the divisor 6, form the fractional part of a mixed number.

2. Reduce $\frac{59}{3}$, to a whole, or mixed number.
Ans. $19\frac{2}{3}$

3. Reduce $\frac{193}{4}$, to a whole or mixed number.
Ans. $48\frac{1}{4}$.

4. Reduce $\frac{961}{17}$, to a whole, or mixed number.
Ans. $56\frac{9}{17}$.

5. Reduce $\frac{12410}{19}$ to a whole, or mixed number.
Ans. $653\frac{3}{19}$

EXAMPLES.

Case 4.—*Where a simple fraction is reduced to the known parts of the integer; as of coin, weight, measure, &c.*

1. What is the value of $\frac{3}{8}$ of a dollar?

NOTE.—Here as the denominator is not contained in the numerator, I multiply the numerator by 100, the cents in a dollar; and the remainder 4, by 10, the mills in a cent.

```
  3
 100
 ——cts. m.
8)300(37 5 Ans.
  24
  ——
   60
   56
   —
    4
   10
   —
   40(5m.
   40
```

again.

```
  $  cts. m.
8)3  00  0
  ————————
     37  5 Ans.
```

NOTE.—Here I annex as many cyphers to the given denomination, as fill all the places to the lowest denomination;—then divide the number thus formed by the denominator, and the quotient is the answer in the several denominations.

2. What is the value of $\frac{7}{16}$ of a dollar?
Ans. 43cts. $7\frac{1}{2}$m.

3. Reduce $\frac{3}{5}$ of a dollar, to its proper quantity.
Ans. 60 cts.

4. Reduce $\frac{7}{25}$ of a dollar, to the known parts of the integer.
Ans. 28cts.

5. What is the value of $\frac{6}{10}$ of a cent? *Ans.* 6m.

6. What is the value of $\frac{9}{17}$ of a cent? *Ans.* $5\frac{5}{17}$m.

7. What is the value of $\frac{12}{13}$ of a pound English money?

```
  12
  20
  —— s. d. qrs.
13)240(18 5  2 2/13 Ans.
   13
   ——
   110
   104
   ——
     6
    12
    ——
    72(5d.
    65
    ——
     7
     4
    ——
    28(2qrs.
    26
    ——
     2
```

NOTE.—Here I multiply the numerator of the fraction, by the shillings in a pound, and divide by the denominator; then multiply the remainder, by the pence in a shilling, and divide again; then multiply the remainder by the farthings in a penny, and divide as before; and find the answer to be £0 . 18 . 5 . 2 $\frac{2}{13}$.

8. What is the value of $\frac{3}{8}$ of a pound? *Ans.* 7s. 6d.

9. What is the value of $\frac{6}{7}$ of £5 . 9?
Ans. £4 . 13 . 5$\frac{1}{7}$.

10. What is the value of $\frac{4}{5}$ of a shilling?
Ans. 9d. 2$\frac{2}{5}$qr.

11. What is the value of $\frac{7}{8}$ of a penny? *Ans.* 3$\frac{1}{2}$qrs.

12. What is the value of $\frac{12}{16}$ of a pound Troy?
Ans. 9oz.

13. What is the value of $\frac{3}{13}$ of a ton?

	Cwt.	qr.	lb.	oz.	dr.
Ans.	4	2	12	14	12$\frac{4}{13}$

14. Reduce $\frac{4}{9}$ of a tun of wine, to its proper quantity.
Ans. 1hhd. 49gal.

15. What is the proper quantity of $\frac{7}{8}$ of a barrel of beer? *Ans.* 31$\frac{1}{2}$gal.

16. What is the proper quantity of $\frac{3}{8}$ of a chaldron of coal? *Ans.* 12 bushels.

17. Reduce $\frac{9}{10}$ of a yard, to its proper quantity.
Ans. 2ft. 8in. 1$\frac{1}{5}$bc.

18. What is the proper quantity of $\frac{4}{7}$ of a mile ?

Ans. 4fur. 22pol. 4yds. 2ft. 1in. $2\frac{1}{7}$bc.

19. Reduce $\frac{7}{16}$ of an acre of land, to its proper quantity.

Ans. 1rood 30pol.

20. Reduce $\frac{3}{4}$ of a ton of round timber, to its proper quantity. *Ans.* 30 feet.

21. Reduce $\frac{7}{13}$ of a day, to its proper quantity.

Ans. 12h. 55min. $23\frac{1}{13}$ sec.

ADDITION.

EXAMPLES.

Where simple fractions are added together, having one common denominator.

1. Add $14\frac{7}{12}$, $49\frac{5}{12}$, $76\frac{8}{12}$, and $38\frac{11}{12}$ together.

$14\frac{7}{12}$
$49\frac{5}{12}$
$76\frac{8}{12}$
$38\frac{11}{12}$

$179\frac{7}{12}$ *Ans.*

NOTE.—In this example, I add all the numerators together; their amount is 31; which I divide by 12, the denominator; the remainder 7, I place below over the denominator; and the quotient 2, I carry to the whole numbers.

2. Add $30\frac{19}{25}$, $+\ 46\frac{23}{25}$, $+\ 9\frac{6}{25}$, and $16\frac{12}{25}$, together.

Ans. $103\frac{10}{25}$ or $\frac{2}{5}$.

3. Add $48\frac{6}{10}$, $+\ 102\frac{7}{10}$, $+\ 8\frac{9}{10}$, and $7\frac{3}{10}$, together.

Ans. $167\frac{5}{10}$ or $\frac{1}{2}$.

4. Add $7\frac{67}{100}$, $+\ 20\frac{38}{100}$, $+\ 86\frac{99}{100}$, and $4\frac{6}{100}$, together.

Ans. $119\frac{10}{100}$ or $\frac{1}{10}$.

5. Add $1\frac{3}{20}$, $+\ 2\frac{8}{20}$, $+\ \frac{17}{20}$, $+\ \frac{15}{20}$, and $8\frac{6}{20}$, together.

Ans. $13\frac{9}{20}$.

6. Add $18\frac{2225}{10000}$, $+\ 3\frac{7906}{10000}$, and $1\frac{9768}{10000}$, together.

Ans. $23\frac{999}{1000}$.

SUBTRACTION.

EXAMPLES.

Where simple fractions are subtracted, having one common denominator ?

	1.	2.	3.	4.
From	$6\frac{7}{12}$	$21\frac{7}{20}$	$97\frac{9}{10}$	75
Take	$2\frac{3}{12}$	$12\frac{13}{20}$	43	$39\frac{67}{100}$
Rem.	$4\frac{4}{12}$	$8\frac{14}{20}$	$54\frac{9}{10}$	$35\frac{33}{100}$

NOTE.—In the first example, the lower fraction is less than the upper; I therefore subtract the lower numerator from the upper, and set down the remainder, over the common denominator.

In the second example, the lower fraction is greater than the upper.

The third example has no fraction in the subtrahend.

The fourth has no fraction in the minuend.

All of which are worked agreeable to the rules.

5. From $100\frac{7}{16}$,—Take $87\frac{3}{16}$,=*Ans.* $13\frac{4}{16}$, or $\frac{1}{4}$.

6. From $97\frac{37}{60}$,—Take $49\frac{58}{60}$,=*Ans.* $47\frac{39}{60}$.

7. From $57\frac{16}{40}$,—Take 28,=*Ans.* $29\frac{16}{40}$, or $\frac{2}{5}$.

8. From 9,—Take $1\frac{4}{5}$,=*Ans.* $7\frac{1}{5}$.

9. From 1,—Take $\frac{67}{100}$,=*Ans.* $\frac{33}{100}$.

10. From 10,—Take $6\frac{99}{100}$,=*Ans.* $3\frac{1}{100}$.

MULTIPLICATION.

EXAMPLES.

Case 1.—*Where whole numbers are multiplied by a simple fraction.*

1. Multiply 69, by $\frac{3}{4}$.

$$\begin{array}{r} 69 \\ \frac{3}{4} \\ \hline 4)207 \\ \hline \text{Pro. } 51\frac{3}{4} \ \textit{Ans.} \end{array}$$

NOTE.—In this first example, I multiply by the numerator of the fraction, and divide that product by the denominator; the quotient is the true product; which shews that $\frac{3}{4}$ of 69, is equal to $51\frac{3}{4}$.

2. Multiply 102, by $\frac{1}{4}$.

$$\begin{array}{r} 102 \\ \frac{1}{4} \\ \hline 4)102 \\ \hline \text{Pro. } 25\frac{2}{4} \text{ or } \frac{1}{2}. \end{array}$$

NOTE.—In this second example I bring down the multiplicand, (as 1 will not multiply,) and divide it by the denominator of the fraction; the quotient is the true product; which shews that $\frac{1}{4}$ of 102, is equal to $25\frac{1}{2}$.

	Mul. by	Product.
3.	$267, \times \frac{7}{9} =$	$207\frac{6}{9}$ or $\frac{2}{3}$.
4.	$5973, \times \frac{5}{6} =$	$4977\frac{3}{6}$ or $\frac{1}{2}$.
5.	$100, \times \frac{9}{10} =$	90.
6.	$36, \times \frac{3}{4} =$	27.
7.	$1000, \times \frac{15}{16} =$	$937\frac{8}{16}$ or $\frac{1}{2}$.
8.	$20, \times \frac{2}{3} =$	$13\frac{1}{3}$.

EXAMPLES.

Case 2.—*Where the multiplier is a mixed number.*

1. Multiply 27, by $6\frac{3}{4}$.

$$\begin{array}{r} 27 \\ 6\frac{3}{4} \\ \hline 4)81 \\ \hline 20\frac{1}{4} \\ 162 \\ \hline \text{Product, } 182\frac{1}{4} \text{ Ans.} \end{array}$$

NOTE.—In this example, I first multiply by the numerator of the fraction, and divide the product by the denominator; then multiply by the whole number, and add this product to the quotient; their sum is the total product or answer.

	Multiply		by		Product.
2.	126,	×	$8\frac{1}{5}$,	=	$1033\frac{1}{5}$.
3.	204,	×	$18\frac{1}{2}$,	=	3774.
4.	96374,	×	$21\frac{6}{7}$,	=	$2106460\frac{2}{7}$.
5.	100,	×	$8\frac{6}{10}$,	=	860.
6.	1000,	×	$1\frac{1}{4}$,	=	1250.
7.	6,	×	$4\frac{1}{6}$,	=	25.

EXAMPLES.

Case 3.—*Where the multiplicand is a mixed number.*

1. Multiply $672\frac{3}{5}$, by 16.

$$\begin{array}{r} 672\frac{3}{5} \\ 16 \\ \hline 5)48 \\ \hline 9\frac{3}{5} \\ 4032 \\ 672 \\ \hline \text{Product, } 10761\frac{3}{5} \text{ Ans.} \end{array}$$

NOTE.—In this example, I first multiply the multiplier by the numerator of the fraction, and divide the product by the denominator; then multiply the whole numbers of the multiplicand, by the multiplier; then add the quotient and products together; and their sum, is the total product or answer.

	Multiply		by		Product.
2.	$410\frac{5}{12}$,	×	6,	=	$2462\frac{6}{12}$ or $\frac{1}{2}$.
3.	$5638\frac{3}{5}$,	×	36,	=	$202989\frac{3}{5}$.
4.	$100\frac{3}{20}$,	×	10,	=	$1001\frac{10}{20}$ or $\frac{1}{2}$.
5.	$8\frac{6}{8}$,	×	9,	=	$78\frac{6}{8}$ or $\frac{3}{4}$.
6.	$1\frac{3}{4}$,	×	2,	=	$3\frac{2}{4}$ or $\frac{1}{2}$.
7.	$100\frac{67}{100}$,	×	100,	=	10067.

DIVISION.

EXAMPLES.

Case 1.—*Where the divisor is a fraction.*

1. Divide 627, by $\frac{3}{4}$.

$$\begin{array}{r} 3)627 \\ \hline 209 \\ 4 \\ \hline \end{array}$$

Quotient, 836 Ans.

Again.

$$\begin{array}{r} 627 \\ \frac{3}{4} \\ \hline 3)2508 \\ \hline \end{array}$$

Quotient, 836 Ans.

NOTE 1.—In this first operation, I divide by the numerator of the fraction first; then multiply the quotient by the denominator; and find that 627, divided by $\frac{3}{4}$, is equal to 836.

NOTE 2.—In this 2d operation, I multiply 1st by the denominator of the fraction; then divide that product by the numerator; and find as before; that 627, divided by $\frac{3}{4}$, is equal to 836.

NOTE 3.—The second method of work, is considered the best.

	Divide		by		Quotient.
2.	4284	←	$\frac{7}{8}$	=	5806
3.	100	÷	$\frac{3}{10}$	=	$333\frac{1}{3}$
4.	97	÷	$\frac{7}{12}$	=	$166\frac{2}{7}$
5.	20	÷	$\frac{4}{5}$	=	25
6.	10	÷	$\frac{1}{10}$	=	100
7.	1	÷	$\frac{2}{3}$	=	$1\frac{1}{2}$

EXAMPLES.

Case 2.—*Where the divisor is a mixed number.*

1. Divide 216, by $4\frac{3}{5}$.

$$\begin{array}{l} 4\frac{3}{5})216 \\ 5 \quad\; 5 \\ \text{— ——— Quotient.} \\ 23)1080(46\frac{22}{23}\ \textit{Ans.} \\ \quad 92 \\ \quad \overline{160} \\ \quad\; 138 \\ \quad \overline{22}\ \text{Rem.} \end{array}$$

NOTE.—In this example, I multiply the whole number of the divisor by the denominator of the fraction, and add in the numerator for a new divisor: I then multiply the dividend by the same number, for a new dividend; and proceed as in whole numbers.

	Divide		by		Quotients.
2.	129	÷	$7\frac{6}{7}$	=	$16\frac{23}{55}$
3.	642	÷	$21\frac{9}{20}$	=	$29\frac{399}{429}$ or $\frac{133}{143}$
4.	100	÷	$10\frac{1}{10}$	=	$9\frac{91}{101}$

EXAMPLES.

Case 3.—*Where the dividend is a mixed number.*

1. Divide $694\frac{1}{4}$ by 3.

$$\begin{array}{rl} 3) & 694\frac{1}{4} \\ 4 & 4 \\ \hline 12) & 2777 \\ \hline \text{Quo.} & 231\frac{5}{12}\ \textit{Ans.} \end{array}$$

NOTE.—In this example, I first multiply the dividend by the denominator of the fraction, and add in the numerator, then multiply the divisor by the same number, and proceed as in whole numbers.

	Divide		by		Quotient.
2.	$666\frac{2}{3}$	÷	6	=	$111\frac{2}{18}$ or $\frac{1}{9}$.
3.	$100\frac{1}{10}$	÷	10	=	$10\frac{1}{100}$.
4.	$48\frac{7}{8}$	÷	16	=	$3\frac{7}{128}$.

DECIMAL FRACTIONS.

DECIMAL FRACTIONS, are a part of Arithmetic, in which any single thing, as one dollar, one pound, one yard, &c. is conceived to be divided into ten equal parts, and those into ten other equal parts, indefinitely, or without end; so long as there is a remainder.

Decimals, are of such a nature, that they vary in the same proportion, as whole numbers; and are managed by the same rules of operation.

Decimals, are distinguished from whole numbers, by having a point, or comma, placed at the left hand; or between them and the integers.

NOTE.—The point, or comma, prefixed to decimals, is called a separatrix.

The denominator of a decimal fraction is always 10, 100, 1000, &c. and need not therefore be expressed; for

the numerator only, may be made use of, to express the true value.

Thus ,5 is $\frac{5}{10}$, or five tenths.

,25 is $\frac{25}{100}$, or twenty-five hundredths.

,175 is $\frac{175}{1000}$, { or one hundred and seventy-five thousandths.

56,75 is $56\frac{75}{100}$, { or fifty-six, and seventy-five hundredths.

Or the denominator is always 1, with so many cyphers annexed, as there are figures in the numerator.

But if the numerator has not so many places as the denominator has cyphers, prefix so many cyphers to it, as will make up the deficiency.

$\frac{5}{100}$ is expressed thus ,05, or five hundredths.

$\frac{5}{1000}$ is expressed thus ,005, or five thousandths, &c.

NOTE.—In this respect, decimal fractions receive the form of whole numbers.

The 1st. 2d. 3d. 4th. &c. places of decimals, counting from the left hand or comma, to the right, are called primes, seconds, thirds, fourths, &c. or tenth, hundreth, thousandth parts, &c.

The first figure at the right hand of the comma or separating point, is called tens: the second hundreds: the third thousands, &c. as in the following table.

TABLE.

Whole Numbers,								*Decimals.*					
Millions,	C Thousands,	X Thousands,	Thousands,	Hundreds,	Tens,	Units,		Tenths,	Hundredths,	Thousandths,	X Thousandths,	C Thousandths,	Millionths.
7	6	5	4	3	2	1	,	2	3	4	5	6	7

NOTE 1.—From this Table, it is evident, that all the figures which stand at the left of the separating point, are integers, (or whole numbers;) and those standing at the right of it, are decimals of one.

NOTE 2.—The first figure at the right of the point, taken alone, is called 2 tenths; for if 1 be divided into ten equal parts, it is 2 of those parts.

NOTE 3.—If the next figure at the right of this 2, be taken with it, they are called 23 hundredths, &c.

Cyphers annexed to a decimal fraction, do not alter its value, for every significant figure continues to possess the same place, as .5, .50, .500, are all of the same value, and each of them equal to $\frac{1}{2}$, or half of one.

Cyphers prefixed to decimals, diminish their value tenfold for each cypher so prefixed; as, 5 is five tenths, ,05 are five hundredths, ,005 five thousandths, &c.

NOTE.—The separating point, or comma, must always be prefixed to decimals, whether there are whole numbers at the left of them, or not; otherwise they may be taken for whole numbers; as 25 is twenty-five, but thus ,25 is twenty-five hundredths of one; the first is a whole number: the second a decimal fraction.

Decimal fractions of unequal denominators, are reduced to one common denominator, by annexing to those which have fewer places, so many cyphers, as make them equal in places, with that which has the most. For these decimals, .5, .35, .459, may all be reduced thus; .500, .350, .459; all having 1000 for their denominator.

NOTE.—That is the greatest decimal, whose highest, or left hand figure is greatest, whether they consist of an equal, or unequal number of places; Thus, ,5 is greater than .459, for if it be reduced to the same numerator with .459, it will be .500, or $\frac{500}{1000}$ which is equal to $\frac{1}{2}$

Decimals are reduced to their lowest terms, by cutting off the cyphers at the right hand; those decimals having no cyphers at the right hand, are already in their lowest terms,

$$\text{thus: } \left.\begin{array}{l} .124000 = .124 \\ .970000 = .97 \\ .500000 = .5 \\ .64 \quad\;\;\; = .64 \end{array}\right\} \text{Their lowest terms.}$$

ADDITION OF DECIMALS.

RULE.

Place the given numbers according to their values; viz. units under units, as in whole nnmbers, and tenths un-

der tenths, &c. in decimals; then proceed as in Simple Addition; observing always to keep the separating points in a perpendicular line.

SUBTRACTION OF DECIMALS.

RULE.

Place the subtrahend, under the minuend; units under units, tenths under tenths, &c. then proceed as in Simple Subtraction; and set the separating point in the remainder, directly under those in the minuend, and subtrahend.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in Simple Multiplication, and point off from the product, as many decimal figures, as there are in both the factors.

NOTE 1.—If there are not so many places, or figures in the product, as there were decimal figures in both the factors; prefix cyphers to them, to supply the number of places deficient: then prefix a point to the left of the decimals.

NOTE 2.—The product of any number, when multiplied by a decimal only, will be less than the multiplicand, in the same proportion, as the multiplier is less than one.

DIVISION OF DECIMALS.

RULE.

Divide as in Simple Division; observing always to have as many decimal places in the quotient, as the dividend has more than the divisor.

When there is a remainder after dividing.

Annex a cypher, or cyphers to the remainder, and divide as before; the quotient figures thus obtained, are decimals.

When there are not so many figures, or places in the quotient, and divisor taken together, as there are decimal places in the dividend.

Prefix a sufficient number of cyphers in the quotient to make up the deficiency.

When the decimal places of the divisor, are more than those of the dividend.

Annex cyphers to the dividend, till the number of decimals are equal.

When the dividend is a whole number, and the divisor a decimal.

Annex so many cyphers to the dividend, as there are decimal places in the divisor; the quotient figures will be whole numbers,till all the annexed cyphers are brought down and divided.

When the dividend is a decimal, and the divisor a whole number.

Divide as in whole numbers, till every figure of the dividend is brought down and divided.

NOTE 1.—If there are not so many places in the quotient, as there are decimals in the dividend, supply the defect by prefixing one or more cyphers.

NOTE 2.—If the divisor is not contained in the dividend, place a cypher in the quotient, and annex a cypher to the dividend.

NOTE 3.—If the divisor is not contained in the dividend after one cypher is annexed, place another cypher in the quotient, and annex another to the dividend; proceed thus till the dividend can be divided.

When the dividend consists of a whole or mixed number, and the decimal places of the divisor, are more than those of the dividend.

Annex a sufficient number of cyphers to the dividend to make them equal; the quotient figures will then be whole numbers, till all the annexed cyphers are brought down and divided.

When decimals, or whole numbers, are to be divided by 10, 100, 1000, *&c.*

Remove the separating point in the dividend, so many places towards the left hand, as there are cyphers in the divisor; then the figures at the left of the point will be whole numbers, and those at the right of the point will be decimals.

NOTE.—If any number, whole, fractional, or mixed, be divided by a decimal only; the quotient will be greater than the dividend, in the same proportion as one is greater than the divisor.

This character + signifies that the decimal is not complete, and that, by annexing cyphers to the remainders, it may be continued still further.

REDUCTION OF DECIMALS.

Case 1.—*To find the value of any decimal, whether of coin, weight, or measure.*

RULE.

Multiply the given decimal, by so many of the next lower denomination, as make one in that denomination of which the given decimal is a part; then point off so many places from the product, as there are places in the given decimal.

Multiply the figures thus pointed off, by the next lower denomination, and point off a remainder as before.

Proceed thus through every inferior denomination, and the figures standing at the left of the several products, will determine the value of the decimal, in the several denominations to which the sum was reduced.

Case 2.—*To reduce a Vulgar Fraction to a Decimal.*

RULE.

Annex a sufficient number of cyphers to the numerator; then divide by the denominator: and the quotient will be the decimal required.

NOTE.—For the cyphers annexed to the numerator; point off as many places in the quotient; but if there be not so many places of figures, make up the deficiency, by prefixing cyphers to the quotient.

Case 3.—*To reduce numbers of one, or of several denominations, to their equivalent decimal values.*

RULE.

Reduce the given sum or quantity, to the lowest denomination mentioned—reduce also the proposed integer to the same denomination—then divide the given sum, or quantity thus reduced, by the proposed integer; and the quotients will be the decimal required.

REDUCTION OF FEDERAL MONEY DECIMALLY.

Federal Money, is reduced from higher to lower denominations, by annexing as many cyphers, as there are places from the given denomination, to the one required.

It is also reduced from lower to higher denominations, by pointing off as many places, or figures, as the least, or given denomination, stands to the right of the one required.

The figures thus pointed off, still belong to their respective denominations.

NOTE.—Although Federal Money consists of five denominations, three only are made use of in accounts, viz. dollars, cents, and mills.

Case 1.—*To reduce dollars, to cents.*

RULE.

Annex two cyphers to the dollars, and the whole will be cents.

Case 2.—*To reduce dollars to mills.*

RULE.

Annex three cyphers to the dollars, and the whole will be mills.

Case 3.—*To reduce dollars and cents, to cents.*

RULE.

Take away the separating point from between the dollars, and cents; or set them down as one whole number, and they will be cents.

Case 4.—*To reduce dollars and cents, to mills.*

RULE.

Take away the separating point, or set them down as one whole number, then annex a cypher, and the whole will be mills.

NOTE.—The reason for annexing, or pointing off one cypher, or figure for mills, and two for cents; is because 10 mills make 1 cent, and 100 cents 1 dollar.

Case 5.—*To reduce dollars, cents and mills, to mills.*

RULE.

Take away both separating points; or set them down as one whole number, and they will be mills.

Case 6.—*To reduce cents, and mills, to mills.*

RULE.

Take away the separating point; or set them down as one whole number, and they will be mills.

Case 7.—*To reduce cents, to mills.*

RULE.

Annex a cypher to the cents, and they will be mills.

Case 8.—*To reduce mills, to cents.*

RULE.

Point off the right hand figure for mills, and the left hand figures will be eents.

Case 9.—*To reduce mills, to dollars.*

RULE.

Point off the right hand figure for mills, the two next for cents, and the left hand figures will be dollars.

Case 10.—*To reduce cents, to dollars.*

RULE.

Point off the two right hand figures for cents, and the left hand figures will be dollars.

QUESTIONS.

What is a Decimal Fraction?
How is a decimal distinguished from a whole number?
What is the point, or comma prefixed to decimals, called?
What numbers are always denominators, in decimal fractions?
What effect have cyphers, when placed to the left hand of a decimal?
What effect have they, when placed to the right hand?
How are decimals reduced to one common denominator?
How are decimals reduced to their lowest terms?
How must whole numbers, and decimals be added?
How must the separating points be placed?
What is the rule for subtracting of decimals?
What is the rule of work, and the method of pointing off decimals, in multiplication.

When there are not so many places in the product, as there are decimals in both the factors; what must be done with them?

How is division of decimals performed?

When there is a remainder after dividing; what must be done with it?

When there are not so many places in the quotient and divisor taken together, as there are decimal places in the dividend; what is then to be done?

When the decimal places of the divisor, are more than those of the dividend; what is to be done?

When the dividend is a whole number, and the divisor a decimal; how do we proceed?

When the dividend is a decimal, and the divisor a whole number; what is the method of work?

When the dividend consists of whole or mixed numbers, and the decimal places of the divisor are more than those of the dividend; what will the quotient be?

When decimals, or whole numbers are to be divided by 10, 100, 1000, *&c.; how do we proceed?*

How do we proceed to find the value of a decimal, as of coin, weight, measure, &c?

How is a vulgar fraction reduced to a decimal?

How are numbers of different denominations reduced to decimals?

How is federal money reduced, from high, to lower denominations?

How is federal money reduced, from low, to higher denominations?

Why should we point off, or annex only one figure for mills, and two for cents?

ADDITION OF DECIMALS.

EXAMPLES.

1.

	Integers.	Decimals.
		.246
		.012
		.02
		.6
		.413
		.5
Sum.	1	.791
Proof.	1	.791

2.

	Integers.	Parts.
	91	.3
	4	.679
	116	.021
	21	.44
	7	.006
		.33
Sum.	240	.776
Proof.		

3.

Integers.	Primes,	Seconds,	Thirds,	Fourths.
8.	1	9	6	7
6.	2	4		
.	3	1	4	
5.	4			
.	0	0	6	4
8.	9	9		

NOTE.—The 1st sum here, is added up and proved in the same manner as whole numbers; the extra figure obtained by adding, is pointed off from the decimals, and is a whole number.

4. Add 27 + 14.49 + .126 + 9.99 + .469 and .2614 together. *Ans.* 52.3364.

5. Add .15 + 100.67 + 1.5 + 33. + .467 and 24.6 together. *Ans.* 160.387.

6. Add 99.99 + 31. + .25 + 60.102 + .29 and 100.347 together. *Ans.* 291.979.

7. What is the sum of 4,23 + 5.075 and 7.0025? *Ans.* 16.3275.

SUBTRACTION OF DECIMALS.

EXAMPLES.

	1.	2.	3.
	Hundreds, Tens, Units, . Tenths, Hundredths, Thousandths, XThousandths.	Integers, Decimals.	Decimals.
From,	1 6 7 . 1 4 0 0	69 . 6	. 962
Take,	9 1 . 2 7 6 7	8 . 34	. 497
Rem.	7 5 . 8 6 3 3	61 . 26	
Proof.	1 6 7 . 1 4 0 0		

NOTE.—The work is here performed in the same manner as in simple subtraction.

Where there is no figure or cypher over the subtrahend, borrow from 10.

	From		Take		Answer.
4.	140.42	—	91.7462	=	48.6738.
5.	46.51		9.24		37.27.
6.	480.		245.0075		234.9925
7.	1,5		.3785		1.1215
8.	962.		.472		961.528
9.	58.25		31.75		26.50

MULTIPLICATION OF DECIMALS.

EXAMPLES.

```
            In. Dec.                          Dec.
1. Multiply 6.29          2. Multiply    .234
         By 2.75                   By    .061
           ----                          ----
           3145                           234
          4403                           1404
         1258                          ------
         -----             Product.   .014274
Product. 17.2975
```

NOTE.—In this example, I point off as many figures for decimals, as there are decimal places in both the multiplicand, and multiplier.

NOTE.—In this example, I prefix a cypher to the product, because there are not so many decimal places by one, in the product, as there are in the multiplicand, and multiplier.

	Multiply	by	Answers.
3.	12.836 ×	.354 =	4.543944
4.	25.238	12.17	307.14646
5.	196.	3.92	768.32
6.	4.1	1.42	5.822
7.	4602.	.075	345.150
8.	.06	.06	.0036

DIVISION OF DECIMALS.

EXAMPLES.

1. Divide 36.2678, by 2.25.

```
Div'r. Div'd.  Quo.
2.25)36.2678(16.11+
     225
     ---
     1376
     1350
     ----
       267
       225
       ---
        428
        225
        ---
        203
```

NOTE 1.—Here the divisor, and dividend, are both mixed numbers.

NOTE 2.—In this example, there being two more places of decimals in the dividend, than in the divisor; I point off the two right hand figures of the quotient, for decimals; but as there is a remainder, there might have been a cypher, or cyphers annexed, and the division continued still further.

2. Divide .3647, by 13.

```
.13).3647(.0280+.
     26
     --
     104
     104
     ---
       7
```

NOTE 1.—Here the dividend is a decimal, and the divisor a whole number.

NOTE 2.—In this example, there being not so many places in the quotient, as there are decimals in the dividend; I supply the defect, by prefixing a cypher: the divisor might still be continued, by annexing a cypher to every remainder.

3. Divide 6.35, by .425.

```
.425)6.350(14.941 &c.
     425
     ----
     2100
     1700
     ----
      4000
      3825
      ----
       1750
       1700
       ----
         500
         425
         ---
          75
```

NOTE 1.—Here the dividend is a mixed number, and the divisor, a decimal.

NOTE 2.—In this example, the dividend has not so many places of decimals as the divisor, I therefore annex a cypher to the dividend; the quotient 14, is a whole number.

There being a remainder, I annex a cypher to it, and divide again; and so on, annexing cyphers, and dividing, until I have three decimal places in the quotient, which might have been continued further.

4. Divide 28, by 267.

```
.267)28000(104.868 &c.
     267
     ----
      1300
      1068
      ----
       2320
       2136
       ----
        1840
        1602
        ----
         2380
         2136
         ----
          244
```

NOTE 1.—Here the dividend is a whole number, and the divisor, a decimal.

NOTE 2.—In this example, the dividend being a whole number, I annex three cyphers to it, the number of decimal places there are in the divisor; the quotient figures are whole numbers.

There being a remainder, I annex a cypher, and divide again, and thus proceed, until there are three decimal places in the quotient; still the decimal is not complete.

5. Divide .769 by 45.

```
45).769(.017 &c.
    45
    ---
    319
    315
    ---
      4
```

Note 1.—Here the dividend is a decimal, and the divisor, a whole number.

Note 2.—In this example, I divide until all the figures in the dividend are brought down; then, as there are not so many places in the quotient, as there are decimals in the dividend; I supply the defect, by prefixing a cypher.

The remainder is so small, I proceed no further with it.

6. Divide .6 by 94.

```
94).600(.00638 &c.
    564
    ---
     360
     282
     ---
      780
      752
      ---
       28
```

Note 1.—Here the dividend is a decimal, and the divisor, a whole number.

Note 2.—In this example, as the divisor is not contained in the dividend, I place a cypher in the quotient; and then annex a cypher to the dividend; which being still too small, I place another cypher in the quotient, and annex another to the dividend; then proceed as in the other examples.

	Divide		by		Answer.
7.	7.735	÷	3.25	=	2.38
8.	.803	÷	22.	=	.0365
9.	29.417	÷	.317	=	92.+
10.	234.70525	÷	64.25	=	3.653
11.	7.25406	÷	957.	=	.00758
12.	4.18	÷	.1812	=	23.068+
13.	19.	÷	.333	=	57.057+

14. Divide 475, by 10, 100, and 1000.

Divisors. Dividend. Quotients.

$$\left.\begin{array}{l}10,\\100,\\1000,\end{array}\right\} 475 = \left\{\begin{array}{l}47.5\\4.75\\.475\end{array}\right.$$

Note.—Here the separating point is removed so many places towards the left hand, as there are cyphers in the divisor.

REDUCTION OF DECIMALS.

EXAMPLES.

Case 1.—*Where the value of a decimal is found in the known parts of the integer; as of coin, weight, measure, &c.*

1. What is the value of .4674 of a pound?

£.	.4674
	20
	9.3480
	12
	4.1760
	4
	.7040
Ans.	9s. 4d.

Note.—Here I multiply the decimal by 20, the shillings in a pound; and point off the increased figure in the product, for shillings; then multiply the remaining decimal by 12, the number of pence in a shilling; and point off the increased figure for pence; then multiply the remaining decimal by 4, the farthings in a penny; but as the product was not increased in number of figures; there were no farthings obtained by multiplying.

2. What is the value of .73968 of a pound? *Ans.* 14s. 9½d.

3. Find the value of .75 of a pound. *Ans.* 15s.

4. What is the value of .8125 of a shilling? *Ans.* 9¾d.

5. Find the proper quantity of .86 of a cwt. *Ans.* 3qrs. 12lb. 5oz. 1gr. 2dr.

6. What is the proper quantity of .8593 of a pound Troy? *Ans.* 10oz. 6pwt. 5gr.

7. What is the value of .761 of a day? *Ans.* 18h. 15m. 50.4sec.

8. What is the value of .397 of a yard? *Ans.* 1qr. 2.352n.

9. What is the value of .3 of a year? *Ans.* 109 days, 12 hours.

10.—What is the value of .875 of a hhd. of wine? *Ans.* 55g. 0qt. 1pt.

11. What is the value of .7 of a lb. Troy? *Ans.* 8oz. 8pwt.

EXAMPLES.

Case 2.—*Where Vulgar Fractions are reduced to Decimals.*

1. Reduce $\frac{17}{25}$ to a decimal.

```
25)17,00(,68 Ans.
   150
   ---
    200
    200
```

NOTE.—Here I annex two cyphers to the numerator, and divide by the denominator; the quotient 68, is the decimal required.

2. Reduce $\frac{3}{4}$, to a decimal. *Ans.* ,75.
3. Reduce $\frac{1}{2}$, to a decimal. *Ans.* ,5.
4. Reduce $\frac{1}{4}$, to a decimal. *Ans.* ,25.
5. Reduce $\frac{1}{3}$, to a decimal. *Ans.* ,3333+.
6. Reduce $\frac{1}{5}$, to a decimal. *Ans.* ,2.
7. Reduce $\frac{7}{8}$, to a decimal. *Ans.* ,875.
8. Reduce $\frac{3}{20}$, to a decimal. *Ans.* ,15.
9. Reduce $\frac{1}{27}$, to a decimal. *Ans.* ,037037+.
10. Reduce $\frac{12}{480}$, to a decimal. *Ans.* ,025.

EXAMPLES.

Case 3.—*Where numbers of different denominations, are reduced to their equivalent decimal values.*

1. Reduce 13s. 4d. 2qrs. to the decimal of a pound.

```
  £             s.  d. qr.
  1             13  4  2
 20             12
---            ---
 20            160
 12              4
---            ---
240        960)642.00000(.66875 Ans.
  4            5760
---            ----
960             6600
                5760
                ----
                 8400
                 7680
                 ----
                  7200
                  6720
                  ----
                   4800
                   4800
                   ----
```

NOTE.—Here I first reduce the given sum to the lowest denomination mentioned; then reduce the proposed integer to the same denomination

I then annex cyphers to the given sum and divide by the proposed integer, until nothing remains; the quotient is therefore the true decimal required.

2. Reduce 7s. 6d., to the decimal of a pound.
Ans. .375.

3. Reduce 15s., to the decimal of a pound.
Ans. .75.

4. Reduce 3 farthings, to the decimal of a shilling.
Ans. .0625.

5. Reduce 25£. 19s. 5½d., to a decimal.
Ans. £25.972916+.

6. Reduce 3qrs. 21lb. Avoirdupois, to the decimal of an cwt. *Ans.* .9375.

7. Reduce 72 days, to the decimal of a year, allowing 365 days to the year. *Ans.* .1972602+.

8. Reduce 2qrs. 2na., to the decimal of a yard.
Ans. .625.

9. Reduce 2 roods, 16 poles, to the decimal of an acre.
Ans. .6.

10. Reduce 4d. to the decimal of a shilling.
Ans. .333+.

REDUCTION OF FEDERAL MONEY, DECIMALLY.

EXAMPLES.

Case 1.—*Where dollars, are reduced to cents.*

1. Reduce $75, to cents. *Ans.* 7500 cents.

NOTE.—In this example, I set down the dollars, and annex two cyphers; because 1 dollar is equal to 100 cents.

	Cents.
2. In $765, how many cents?	*Ans.* 76500.
3. In $10, how many cents?	*Ans.* 1000.
4. In $2, how many cents?	*Ans.* 200.

EXAMPLES.

Case 2.—*Where dollars are reduced to mills.*

1. Reduce $225, to mills. *Ans.* 225000 mills.

NOTE.—In this example, I set down the dollars, and annex three cyphers; because 1 dollar is equal to 1000 mills.

	Mills.
2. In $496, how many mills?	*Ans.* 496000.
3. In $67, how many mills?	*Ans.* 67000.
4. In $1, how many mills?	*Ans.* 1000.

EXAMPLES.

Case 3.—*Where dollars, and cents, are reduced to cents.*

1. Reduce $567,94, to cents. *Ans.* 56794 cents.

Note.—In this example, I take away the separating point, or set them down as one whole number.

	Cents.
2. In $999,99, how many cents?	*Ans.* 99999.
3. In $86,25, how many cents?	*Ans.* 8625.
4. In $4,06, how many cents?	*Ans.* 406.

EXAMPLES.

Case 4. *Where dollars, and cents, are reduced to mills.*

1. Reduce $321,07, to mills. *Ans.* 321070 mills.

Note.—In this example, I take away the separating point, and annex a cypher.

	Mills.
2. In $407,19 how many mills?	*Ans.* 407190.
3. In $55,55, how many mills?	*Ans.* 55550.
4. In $1,01, how many mills?	*Ans.* 1010.

EXAMPLES.

Case 5. *Where dollars, cents, and mills, are reduced to mills.*

1. Reduce $471,31,2, to mills. *Ans.* 471312 mills.

Note.—In this example, I take away both the separating points.

	Mills.
2. In $876,54,3, how many mills?	*Ans.* 876543.
3. In $35,18,6, how many mills?	*Ans.* 35186.
4. In $4,90,1, how many mills?	*Ans* 4901.

EXAMPLES.

Case 6. *Where cents, and mills, are reduced to mills.*

c. m.

1. Reduce 59,8 to mills. *Ans.* 598 mills.

Note.—In this example, I take away the separating point.

c. m.	Mills.
2. In 94,1, how many mills?	*Ans.* 941.
3. In 17,5, how many mills?	*Ans.* 175.
4. In 40,6, how many mills?	*Ans.* 406.

EXAMPLES.

Case 7. *Where cents, are reduced to mills.*

1. Reduce 81 cents, to mills. *Ans.* 810 mills.

NOTE.—In this example, I annex a cypher.

Mills.

2. In 23 cents, how many mills? *Ans.* 230.
3. In 84 cents, how many mills? *Ans.* 840.
4. In 1 cent, how many mills? *Ans.* 10.

EXAMPLES.

Case 8.—*Where mills, are reduced to cents.*

c. m.

1. Reduce 267 mills, to cents. *Ans.* 26,7.

NOTE.—In this example, I point off the right hand figure for mills; the left hand figures are cents.

c. m.

2. In 134 mills, how many cents? *Ans.* 13,4.
3. In 960 mills, how many cents? *Ans.* 96.
4. In 25 mills, how many cents? *Ans.* 2,5.

EXAMPLES.

Case 9.—*Where mills, are reduced to dollars.*

1. Reduce 965031 mills, to dollars. *Ans.* $965,03,1.

NOTE.—In this example, I point off the right hand figure for mills, the two next for cents, and the remaining left hand figures are dollars.

Answer.

2. In 530678 mills, how many dollars? $530,67,8.
3. In 48123 mills, how many dollars? $48,12,3.
4. In 5555 mills, how many dollars? $5,55,5.

EXAMPLES.

Case 10.—*Where cents, are reduced to dollars.*

1. Reduce 87642 cents, to dollars. *Ans.* $876,42.

NOTE.—In this example, I point off the two right hand figures for cents, and the left hand figures are dollars.

Answer.

2. In 70639 cents, how many dollars? $706,39.
3. In 4307 cents, how many dollars? $43,07.
4. In 615 cents, how many dollars? $6,15.

PRACTICE.

Practice is a contraction of the Rule of Three Direct; when the first term happens to be an unit, or one.

It derives its name from frequent use, and is an easy, as well as a concise method, of resolving most questions that occur in trade, or business.

PROOF.

Practice may be proved by the Single Rule of Three, or by Compound Multiplication.

Note.—Previous to working in this rule, the following tables should be committed to memory.

TABLES.

ALIQUOT, OR EVEN PARTS.

Parts of a Pound.

s.	d.		£
10	0	is	$\frac{1}{2}$
6	8	=	$\frac{1}{3}$
5	0		$\frac{1}{4}$
4	0		$\frac{1}{5}$
3	4		$\frac{1}{6}$
2	6		$\frac{1}{8}$
2	0		$\frac{1}{10}$
1	8		$\frac{1}{12}$
1	0		$\frac{1}{20}$

Parts of a Shilling.

d.		s.
6	is	$\frac{1}{2}$
4	=	$\frac{1}{3}$
3		$\frac{1}{4}$
2		$\frac{1}{6}$
$1\frac{1}{2}$		$\frac{1}{8}$
1		$\frac{1}{12}$

Parts of a Penny.

qr.		d.
2	=	$\frac{1}{2}$
1		$\frac{1}{4}$

Parts of a Dollar.

cts.		$
50	is	$\frac{1}{2}$
$33\frac{1}{3}$	=	$\frac{1}{3}$
25		$\frac{1}{4}$
20		$\frac{1}{5}$
$16\frac{2}{3}$		$\frac{1}{6}$
$12\frac{1}{2}$		$\frac{1}{8}$
10		$\frac{1}{10}$
$8\frac{1}{3}$		$\frac{1}{12}$
$6\frac{1}{4}$		$\frac{1}{16}$
5		$\frac{1}{20}$
4		$\frac{1}{25}$
2		$\frac{1}{50}$

Parts of a Ton.

Cwt.	qr.		T.
10	0	is	$\frac{1}{2}$
5	0	=	$\frac{1}{4}$
4	0		$\frac{1}{5}$
2	2		$\frac{1}{8}$
2	0		$\frac{1}{10}$
1	0		$\frac{1}{20}$

Parts of a Cwt.

qrs.	lb.		Cwt.
2	0	is	$\frac{1}{2}$
1	0	=	$\frac{1}{4}$
0	16		$\frac{1}{7}$
0	14		$\frac{1}{8}$
0	8		$\frac{1}{14}$
0	7		$\frac{1}{16}$
0	4		$\frac{1}{28}$

Parts of $\frac{1}{2}$ a Cwt.

lb.		$\frac{1}{2}$ Cwt.
28	is	$\frac{1}{2}$
14		$\frac{1}{4}$
8		$\frac{1}{7}$
7		$\frac{1}{8}$
4		$\frac{1}{14}$
2		$\frac{1}{28}$

The aliquot, or even part of any number, is just such a part of it, as being taken a certain number of times, will exactly make that number;—thus, 4 is an aliquot part of 12, that is, $\frac{1}{3}$ part of it, for 4 will measure 12, three times, without a remainder.

5 is an aliquot part of 20.

6 is an aliquot part of 24, &c.

NOTE.—Practice admits of a great variety of cases, but those the most useful and necessary to be well understood, are here selected.

When the price of the given quantity is 1£. 1s. 1d. or 1qr. English Money; or 1$. 1ct. or 1m. Federal Money per yard, pound, &c. then the quantity itself will be the answer to the question, in that denomination of money in which the price of one was given.

Case 1.—*When the price is given in Federal Money.*

RULE.

Multiply the price and quantity together, and the product will be the answer in the lowest denomination mentioned in the price; then point off in the product for the denominations less than dollars, as many places as there are in the given price.

Or,—*When the price of one yard, &c. is an aliquot part of a dollar.*

Divide the quantity by that even part, and the quotient will be the answer in dollars, &c.

Case 2.—*When the price is given in English Money, and is an even part of a penny.*

RULE.

Set down the quantity, or given number of articles, as so many pence; then divide by the aliquot parts of a penny, and the quotient will be the answer in pence, &c.; which may be reduced to shillings and pounds.

Case 3.—*When the given price is an aliquot part of a shilling.*

RULE.

Set down the quantity as so many shillings; then divide the given number by the aliquot part of a shilling, and the quotient will be shillings, &c.; which may be reduced to pounds.

NOTE.—If the given price is not an even part of a shilling, divide by some even part; and take parts of that part, &c. then add the several quotients together, and their sum will be shillings.

Case 4—*When the given price is between one, and two shillings.*

RULE.

Set down the quantity as so many shillings: then take parts for the excess; (or price more than a shilling) then add that excess to the given quantity: and their sum will be shillings, &c. which may be reduced to pounds.

Case 5.—*When the price is shillings, or shillings and pence, and an even part of a pound.*

RULE.

Set down the quantity as so many pounds; then divide by the even part, and the quotient will be the answer in pounds, &c.

Case 6.—*When the price is shillings, or shillings and pence, and not an even part of a pound.*

RULE.

Set down the quantity as so many pounds; then take parts of parts, of the given price for divisors; and the sum of the quotients will be the answer in pounds, &c.

Or:

Multiply the quantity by the shillings in the price, and take parts of a shilling for the odd pence, &c.—Then add the product, and quotients together; and their sum will be the answer in shillings, &c. which may be reduced to pounds.

Case 7.—*When the price is between* 1 *and* 2 *pounds.*

RULE.

Set down the quantity as so many pounds; then for the shillings, and pence, take parts of the price at 1£. and their sum will be the answer in pounds, &c.

Case 8.—*When the price is pounds only.*

RULE.

Multiply the quantity by the number of pounds, and the product will be the answer in pounds.

Case 9.—*When the price is pounds, shillings, &c.*

RULE.

Multiply the quantity by the number of pounds, and for the shillings, &c. take the aliquot parts of the quantity, as the price at 1£.

Case 10.—*When the price is any number of shillings under 24.*

RULE.

Multiply the quantity by half the number of shillings in the price; double the right hand figure of the product for shillings, and the left hand figures will be pounds.

Case 11.—*When both the given price and quantity consist of different denominations.*

RULE.

Multiply the given price by the integers in the quantity; then take parts for the rest of the quantity, from the price of an integer; then add the product, and quotients together, and their sum will be the answer.

Or,

When the integers in the quantity are a composite number.

Multiply the given price by one of those component parts and that product by the other; then take parts for the rest from the price of an integer.

QUESTIONS.

What is Practice? From what does Practice derive its name?
How is Practice proved? What part of a pound is 6s. 8d.?
What part of a shilling is $1\frac{1}{2}d$? What part of a penny is 1qr.?
What part of a dollar is $33\frac{1}{3}$ cents? What part of a tun is $2\frac{1}{2}$ Cwt.?
What part of a Cwt. is 16 lb.? What part of a $\frac{1}{2}$ Cwt. is 4lb.?
What is meant by aliquot, or even part?
When the price is given in Federal Money; how do we proceed?

When the price is an even part of a penny; what is the method of work?

When the price is an even part of a shilling; how is the work performed?

When the price is between one and two shillings, what is the rule?

What is the rule of work, when the price is an even part of a pound?

When the price is not an even part of a pound, what method should be pursued?

Suppose the price is between 1 and 2 pounds what is the rule?

How should we proceed when the price is pounds only?

Suppose the price to be pounds, and shillings; what is to be done?

Tell me the rule of work, when the price is an even number of shillings under 24.

Inform me how to proceed, when the given quantity, and price, are both of different denominations?

EXAMPLES.

Case 1.—*Where the price is given in Federal Money.*

1. What cost 326 yards of cloth, at 25 cents per yd.?

Quantity, 326 yds.
Price, 25 cts.

1630
652

\$81,50 *Ans.*

NOTE.—Here I multiply the quantity by the price.

By the first method of work.

Again.

cts. \$ \$
25=¼)326, at \$1 per yd.

Ans. \$81,50

By the 2d method of work.

NOTE.—Here I divide by 4; because 25 cents, are equal to ¼ of a dollar.

2. What cost 265 yards, at 12½ cents per yard?

½)265 yds.
12½ cts.

132½=½ of 265
3180

\$33,12½ *Ans.*

By Multiplication.

NOTE.—Here I first take ½ of the quantity for the ½ cent; then multiply by the 12 cents.

Again.

cts. \$
12½=⅛)265

\$33,12,5 *Ans.*

By Division.

NOTE.—Here I divide the quantity by 8; because 12½ cts., is ⅛ of a dollar.

3. What cost 450 yds., at 50 cts. per yd.?
Ans. $225.

4. What cost 1050 yds., at $6\frac{1}{4}$ cts. per yd.?
Ans. $65.62.5.

5. What cost 618 yds., at $87\frac{1}{2}$ cts. per yd.?
Ans. $540.75.

6. What cost $333\frac{1}{3}$ yards, at 24 cents per yard?

$333\frac{1}{3}$ yds.
$\frac{1}{3}$) 24 cents.

8 = $\frac{1}{3}$ of 24.
1332
666

Ans. $80.00 } value of $333\frac{1}{3}$ yds. at 24 cts. per yard.

NOTE.—Here, I divide the price by 3, for the $\frac{1}{3}$ of a yard; then multiply the rest of the quantity by 24; the quotient, and product added together, gives the answer.

7. What cost $614\frac{1}{4}$ yds., at 67 cents per yard?
Ans. $$411.54\frac{3}{4}$.

8. What cost $97\frac{1}{8}$ yds., at 20 cts. per yard?
Ans. $$19.42\frac{1}{2}$.

9. What cost $12\frac{1}{2}$ yds., at 12 cts. per yard?
Ans. $1.50.

10. What cost 693 yards, at $$3.47\frac{3}{4}$ per yard?

NOTE.—Here, I first take $\frac{1}{2}$ of the quantity; then $\frac{1}{2}$ of that $\frac{1}{2}$, for the $\frac{3}{4}$ of a cent; then multiply by the whole numbers.

$\frac{1}{2}$)693 Quantity.
$347\frac{3}{4}$ Price.

$\frac{1}{2}$)$346\frac{1}{2}$ = $\frac{1}{2}$ of 693 }
$173\frac{1}{4}$ = $\frac{1}{2}$ of $346\frac{1}{2}$ } = $\frac{3}{4}$ of 693.
4851
2772
2079

Ans. $$2409.90\frac{3}{4}$. } value of 693 yds., at $347\frac{3}{4}$ cts. per yd.

11. What cost 917 yards, at $1.12.5 per yard?
Ans. $1031.62.5.

12. What cost 328 yds., at $13\frac{1}{3}$ cts. per yd.?
Ans. $$43.73\frac{1}{3}$.

13. What cost 167½ yds., at $2.91.6 per yd.?
Ans. $488.43.

14. What cost 476 yds., at 4 mills per yd.?

476 yards.
4 mills.

$1.90.4 *Answer.*

NOTE.—Here, I multiply the No. of yds. by the No. of mills; the answer is therefore mills, which I point of into mills, cents and dollars.

15. What cost 2785 yards, at 1 mill per yard?
Ans. $2.78.5.

16. What cost 126½ yards, at 7 mills per yard?
Ans. $0.88.5½.

17. What cost 816 yards, at 3¼ mills per yard?
Ans. $2.65.2.

EXAMPLES.

Case 2.—*Where the price is given in English Money, and is an aliquot part of a penny.*

1. What will 2672 yards of tape come to, at 1qr. per yard?

qr. d. d.
1=¼)2672, at 1d. per yd.

12)668d. at 1qr. per yd.

2|0)5|5.8d.

£2.15.8, Val. of 2672 yds. at 1qr. per yard.

NOTE.—I here set down the number of yards as so many pence, and divide first by 4, the number of farthings in a penny; then by 12, and 20.

2. What will 6125¾ yds. come to, at 3qrs. per yd.?

qr. d. d. qr.
2=½)6125.3, at 1d. per yd.

1=½)3062.3 } The fractional parts
1531.1 } of a farthing are not set down.

12)4594.0 at 3qrs. per yd.

2|0)38|2.10d.

£19.2.10 } val. of 6125¾yds. at 3qrs. per yd.

NOTE 1.–Here I take ½ of the price at a penny, for the 2 farthings; then ½ of the price at 2 farthings, for the 1 farthing; and add the two quotients together; which sum gives the whole value in pence.

NOTE 2.—The 3 farthings which are placed in the dividend, is the value of ¾ of a yd., at 1d. pr. yd.

3. What cost 5704 yards, at 1qr. per yard?
Ans. £5.18.10.

4. What cost 362 yards, at 2qr. per yard?
Ans. £0.15.1.

5. What cost 9563 yards, at 3qr. per yard?
Ans. £29.17.8¼.

6. What cost 7672 yards, at 2qr. per yard?
Ans. £15.19.8.

7. What cost 354 yards, at 1qr. per yard?
Ans. £0.7.4½.

8. What cost 263 yards, at 3qr. per yard?
Ans. £0.16.5¼.

EXAMPLES.

Case 3.—*Where the given price is an aliquot part of a shilling.*

1. What will 269½ yards come to, at 3d. per yard?

NOTE.—Here, 3d. being the ¼ part of a shilling, I divide the price at 1 shilling per yard by 4; the quotient is shillings, &c.: which I reduce to pounds.

```
d.     s.  s.  d.
3=¼)269.6      { Value of 269½ yds. at 1s. per yd.
    ---------
    2|0)6|7.4½
    ---------
      £3.7.4½  { Value of 269½ yds. at 3d. per yd.
    ---------
```

2. What cost 6932 yards, at 1d. per yard?
Ans. £28.17.8.

3. What cost 567½ yards, at 1½d per yard?
Ans. £3.10.11¼.

4. What cost 862 yards, at 2d per yard?
Ans. £7.3.8.

5. What cost 1218 yards, at 2½d. per yard?

```
d.   s.
2=⅙)1218, at 1s. per yard.
    ----
½=¼)  203  value at 2d. per yd.
       50.9 value at ½d. per yd.
     -----
 2|0)25|3.9
     -----
  £12.13.9 { Value of 1218 yards, at 2½d. per yard.
  --------
```

NOTE.—Here I say,
2d is ⅙ of 1s.
½d. is ¼ of 2d.

6. What cost 8012 yards, at $2\frac{3}{4}$d. per yard?
Ans. £91.16.1.

7. What cost $7612\frac{1}{2}$ yards, at 3d. per yard?
Ans. £95.3.$1\frac{1}{2}$.

8. What cost 6128 yards, at 4d. per yard?
Ans. £102.2.8.

9. What cost 6001 yards, at $4\frac{1}{2}$d. per yard?

d. s. s.
$3=\frac{1}{4}$)6001, at 1s. per yard.

$1\frac{1}{2}=\frac{1}{2}$)1500.3d. value at 3d. per yd.
750.$1\frac{1}{2}$ value at $1\frac{1}{2}$ per yd.

2|0)2251|0.$4\frac{1}{2}$

Ans. £112.10.$4\frac{1}{2}$ } Value of 6001 yds. at $4\frac{1}{2}$d. per. yd.

NOTE.—Here I say, 3d. is $\frac{1}{4}$ of 1s. $1\frac{1}{2}$d. is $\frac{1}{2}$ of 3d.

10. What cost 3210 yards, at 5d. per yard?
Ans. £66.17.6.

11. What cost 4596 yards, at 6d. per yard?
Ans. £114.18.

12. What cost 1476 yards, at 7d. per yard?
Ans. £43.1.

13. What cost 112 yards, at $7\frac{1}{2}$d. per yard?

d. s. s.
$6=\frac{1}{2}$)112, at 1s. per yard.

$1\frac{1}{2}=\frac{1}{4}$) 56s. at 6d. per yd.
14s. at $1\frac{1}{2}$d. per yd.

2|0)7|0

Ans. £3.10, Value of 112 yds. at $7\frac{1}{2}$d. per yd.

NOTE.—Here I say, 6d. is $\frac{1}{2}$ of 1s. $1\frac{1}{2}$d. is $\frac{1}{4}$ of 6d.

14. What cost 7100 yards, at 8d. per yard?
Ans. £236.13.4.

15. What cost 675 yards, at 9d. per yard?
Ans. £25.6.3.

16. What cost $5060\frac{1}{2}$ yds. at 10d. per yard.?
Ans. £210.17.1.

17. What cost 3254½ yds. at 10½d. per yard?

d.	s.	s. d.	
6 = ½)		3254.6	at 1s. per yd.
3 = ½)		1627.3	
1½ = ½)		813.7½	
		406.9¾	
	2|0)	284|7.8¼	

NOTE 1.—Here I say, 6d. is ½ of 1s. 3d. is ½ of 6d. 1½d. is ½ of 3d.

NOTE 2.—I set down the 6d. in the dividend after the shillings, as being the value of ½ a yard, at 1s. per yard.

Ans. £142.7.8¼ Value of 3254½ yds., at 10½d. per yd.

18. What cost 729 lbs. at 10½d. per lb.? *Ans.* £31.17.10½.

19. What cost 3271½ lbs. at 7d. per lb.? *Ans.* £95.8.4½.

20. What cost 7181¾ lbs. at 5d. per lb.? *Ans.* £149.12.4¾.

EXAMPLES.

Case 4.—*Where the given price is between one and two shillings.*

1. What is the value of 6784 yds., at 1s. 1d. per yd.?

d.	s.	s.	
1 = $\frac{1}{12}$)		6784	at 1s. per yd.
		565.4d.	at 1d. pr. yd.
	2|0)	734|9.4	

NOTE.—Here, I set down the quantity as so many shillings, then take the one twelfth part, and add to it; which sum I then reduce to pounds.

Ans. £367.9.4, Value 6784 yds., at 1s. 1d. per yd.

2. What cost 6100 yds., at 1s. 1½d. per yd.? *Ans.* £343.2.6.

3. What cost 1210 yds., at 1s. 2d. per yd.? *Ans.* £70.11.8.

4. What cost 1479 yds., at 1s. 3d. per yd.? *Ans.* £92.8.9.

5. What cost $864\frac{1}{4}$ yds., at 1s. 4d. per yd.?

d. s. s. d.
4=$\frac{1}{3}$)864.6 at 1s. per yd.
288.2 at 4d. per yd.

2|0)115|2.8

NOTE.—4d. being one third of a shilling, I add the third part to the price at 1s.

Ans. £57.12.8, Value of $864\frac{1}{4}$ yds., at 1s. 4d. per yd.

6. What cost 1218 yds. at 1s. $4\frac{1}{2}$d. per yd.? *Ans.* £83.14.9.

7. What cost $647\frac{3}{4}$ yds., at 1s. 5d. per yd.? *Ans.* £45.17.$7\frac{3}{4}$.

8. What cost 4560 yds., at 1s. 6d. per yd.? *Ans.* £342.0.0.

9. What cost $972\frac{3}{4}$ yards at 1s. 7d. per yard?

d. s. s. d.
6=$\frac{1}{2}$)972.9 at 1s. per yard.
1=$\frac{1}{6}$)486.$4\frac{1}{2}$
81.$0\frac{3}{4}$

2|0)154|0.$2\frac{1}{4}$

NOTE 1.—6d. is $\frac{1}{2}$ of 1s. 1d. is $\frac{1}{6}$ of 6d.

NOTE 2.—I set down the 9d. in the dividend, as the value of $\frac{3}{4}$ of a yard, at 1s. per yard.

Ans. £77.0.$2\frac{1}{4}$ Value of $972\frac{3}{4}$ yards; at 1s. 7d. per yd.

10. What cost 9876 yards, at 1s. $7\frac{1}{2}$d. per yard? *Ans.* £802.8.6.

11. What cost 888 yards, at 1s. 8d. per yard? *Ans.* £74.0.0.

12. What cost 4321 yards, at 1s. 9d. per yard? *Ans.* £378.1.9

13. What cost $752\frac{1}{2}$ yards, at 1s. 10d. per yard?

d. s. s. d.
6=$\frac{1}{2}$)752.6 at 1s per yard.
3=$\frac{1}{2}$)376.3 at 6d. per yard.
1=$\frac{1}{3}$)188.$1\frac{1}{2}$ at 3d. per yd.
62.$8\frac{1}{2}$ at 1d. per yd.

2|0)137|9.7

NOTE 1.—6d. is $\frac{1}{2}$ of 1s. 3d. is $\frac{1}{2}$ of 6d. 1d. is $\frac{1}{3}$ of 3d.

NOTE 2.—When the aliquot parts are difficult to find, work by the Single Rule of Three Direct.

Ans. £68.19.7 Value of $752\frac{1}{2}$ yards; at 1s. 10d. per yd.

14. What cost 6700$\frac{1}{2}$ yards, at 1s. 10$\frac{1}{2}$. per yard?

Ans. £628.3.5$\frac{1}{4}$.

15. What cost 1800$\frac{3}{4}$ yards, at 1s. 10$\frac{1}{2}$d. yer yard?

Ans. £168.16.4$\frac{3}{4}$

16. What cost 968 yards, at 1s. 11$\frac{1}{2}$d. per yard?

d. s. s.
6=$\frac{1}{2}$ } 966 at 1s. per yard.
4=$\frac{1}{3}$ }
484 at 6d. per yard.
1=$\frac{1}{4}$)322.8 at 4d. per yd.
$\frac{1}{2}$ =$\frac{1}{2}$) 80.8 at 1d. per yd.
40.4 at $\frac{1}{2}$d. per yd.

2|0)189|5.8

£94.15.8 *Ans.*

By Division.

$\frac{1}{2}$)968 yards,
23$\frac{1}{2}$d.

484
2904
1936

12)22748

2|0)189|5.8

Ans. £94.15.8

By Multiplication.

NOTE 1.—The aliquot parts are here taken thus—6d. is $\frac{1}{2}$ of 1s.
4d. is $\frac{1}{3}$ of 1s.
1d. is $\frac{1}{4}$ of 4d.
$\frac{1}{2}$d. is $\frac{1}{2}$ of 1d.

NOTE 2.—The first operation of the above sum is performed by Division, agreeable to the foregoing rule of practice in this case.

NOTE 3.—The second operation is performed by multiplication, which is much the easiest way to find an answer, where the aliquot parts in the price, are not readily come at.

EXAMPLES.

Case 5.—*Where the price is shillings, or shillings and pence, and is an even part of a pound.*

1. What is the value of 496 yds., at 1s. 8d. per yd.?

s. d. £ £
1 8=$\frac{1}{12}$)496 at 1£ per yd.

£41.6.8 *Ans.*

NOTE.—I here divide the quantity or pounds, by 12; because 1s. 8d. is one twelfth of a £.

2. What cost 352 yards, at 2s. 6d. per yd.?

Ans. £44.0.0.

3. What cost 365 yards, at 3s. 4d. per yd.?

Ans. £60.16.8.

4. What cost 347 yards, at 4s. per yd.?

Ans. £69.8.

5. What cost 769½ yds. at 6s. 8d. per yd.?

s. d. £ £ s.
6 8=$\frac{1}{3}$)769.10 at 1£ pr. yd.

£256.10 *Ans.*

NOTE.—I here set down the 10s. for the ½ yd. and divide the whole by 3; because 6s. 8d. is one third of a £.

EXAMPLES.

Case 6.—*Where the price is shillings, or shillings and pence, and not an even part of a £.*

1. What is the value of 168 yds., at 3s. 9d. per yd.?

s. d. £ £
3 4=$\frac{1}{6}$)168 at 1£ per yd.

4=$\frac{1}{10}$)28 value at 3s. 4d.
1=$\frac{1}{4}$) 2.16 value at 4d.
14 value at 1d.

Ans. £31.10 val. at 3s. 9d.

NOTE 1.—The parts here are thus taken—
3s. 4d. is $\frac{1}{6}$ of a £.
4d. is $\frac{1}{10}$ of 40d.
1d. is $\frac{1}{4}$ of 4d.

NOTE 2.—In this first operation, the quantity is set down as so many pounds, and the aliquot parts taken as directed in the rule.

d. s. s.
6=$\frac{1}{2}$)168 at 1s. per yd.
3s.

504 value at 3s.
3=$\frac{1}{2}$) 84 value at 6d.
42 value at 3d.

2|0)63|0

£31.10 *Answer.*

NOTE 3.—Here, the quantity is set down as so many shillings, and multiplied by the number of shillings; then parts taken for the odd pence.

2. What cost 1296 yds., at 7s. 4½d. per yd.?

Ans. £477.18.0.

3. What cost 176 yds., at 5s. 7d. per yd.?

Ans. £49.2 8.

4. What cost 139 yds., at 9s. 10d per yd.?

Ans. £68.6.10.

5. What cost 947 yds., at 13s. 9d. per yd.?

s. £ £
10=½)947 at 1£ per yd.
s. d.
2 6=¼)473.10 at 10s.
1 3=½)118. 7.6 at 2s. 6d.
59. 3.9 at 1s. 3d.

Ans. £651. 1.3
By Division.

NOTE.—Here I say—
10s. is ½ of a £.
2s. 6d. is ¼ of 10s.
1s. 3d. is ½ of 2s. 6d.

d. s. s.
6=½)947 at 1s. per yd.
13

2841
947
3=½) 473.6
236.9

2|0)1302|1.3

Ans. £651.1.3
By Multiplication.

6. What cost 218½ yds., at 12s. 6d. per yd.? *Ans.* £136.11.3.

7. What cost 1129 yds., at 17s. 8d. per yd.? *Ans.* £997.5.8.

8. What cost 100 yds., at 19s. per yd.? *Ans.* £95.

EXAMPLES.

Case 7.—*Where the price is between* 1 *and* 2 *pounds.*

1. What is the value of 628 yds., at 22s. 6d. per yd.?

s. d. £ £
2 6=⅛)628 at 1£ per yd.
78.10 at 2|6 pr.yd.

£706.10 *Ans.*

NOTE.—Here, 628£, is the value of 628 yds. at 20s. or 1£ pr.yd., and £78.10s. is the value at 2s. 6d. per yard, which added together, gives the amount, or value at 22s. 6d. per yard.

2. What cost 456½ yds., at 27s. 6d. per yd.? *Ans.* £627.13.9.

3. What cost 100 yards, at 30s. per yd.? *Ans.* £150.

4. What cost 96 yards, at 36s. per yd.? *Ans.* £172.16.

EXAMPLES.

Case 8.—*Where the price is pounds only.*

1.—What is the value of 325 yards, at £2 per yd.?

yds. or
325£ at 1£ per yd.
2 price per yd.

Ans.£650 at 2£ per yd.

NOTE.—Here, I set down the No. of yds. as so many pounds, and multiply by the price per yd.

2. What cost 467 yards, at 3£ per yd.?
Ans. £1401.

3. What cost 121 Cwt., at 4£. per Cwt.?
Ans. £484.

4. What cost 97 Cwt., at 5£ per Cwt.?
Ans. £485.

EXAMPLES.

Case 9.—*Where the price is pounds, shillings, &c.*

1. What is the value of 649½ yards, at £2.4 per yd.?

s. £ £ s.
4=⅕)649.10 at 1£ per yd.
2

1299.00 Val.at 2£ pr.yd.
129.18 Val.at 4s. pr.yd.

An. *l.*1428.18 Value at £2.4 per yd.

NOTE.—Here I set down the price of the quantity at 1£ per yd.; and multiply by the pounds in the price—then take one fifth of the price at 1£, for the 4s.

2. What cost 427 Cwt. at 6*l.* 4s. per Cwt.?
Ans. £2647.8.

3. What cost 521 hhds., at £9.6.8 per hhd.?
Ans. £4862.13.4.

4. What cost 356 Tuns, at £27.11 per Tun?
Ans. £9807.16.

EXAMPLES.

Case 10.—*Where the price is an even number of shillings under 24.*

1. What is the value of 416 yds. at 2s. per yd.?

416
1

Ans. £41.12

NOTE.—Here I place 1 for a multiplier, because 1 shilling is ½ of the price, and say, once 6 is 6; then double the 6 for shillings, and bring down the remaining figures for pounds.

2. What cost 347 yards, at 4s. per yd.?

Ans. £69.8.

3. What cost 703 yards, at 6s. per yd.?

Ans. £210.18

4. What cost 589 yards, at 8s. per yd.?

Ans. £235.12.

5. What cost 872 yards, at 10s. per yd.?

```
      872
        5
     ------
Ans. £436.0
     ------
```

NOTE.—I here place 5 for a multiplier, because it is ½ the price at 10s.; I then multiply the right hand figure, and double the product; which makes 20s. I then put a cypher in the place of shillings, and carry one to the next product for pounds.

6. What cost 745 yards, at 16s. per yd.?

Ans. £596.

7. What cost 214 yards, at 18s. per yd.?

Ans. £192.12.

EXAMPLES.

Case 11.—*Where both the given price and quantity consist of different denominations.*

1. What cost 3cwt. 3qrs. 21lb. of sugar, at £2,7,6 per cwt.?

```
qrs. cwt. £ s. d.
  2 = ½ )2  7  6
           3,3,21
        ----------
         7  2  6  value of 3cwt.
  1=½)   1  3  9  value of 2qrs.
14lb.=½)   11 10½ value of 1qr.
 7lb.=½)    5 11¼ value of 14lb.
            2 11½ value of 7lb.
        ----------
Ans. £9  7  0¼ Value of the whole.
```

NOTE.—After multiplying by the 3 cwt. I say—
2qrs. is ½ of a cwt.
1qr. is ½ of 2qrs.
14lb. is ½ of 1qr.
7lb. is ½ of 14lb.

2. What cost 2cwt. 1qr. 14lb. at 2£ 19s. 8d. per cwt.?

Ans. £7,1,8½.

3. What cost 7cwt. 3qr. 16lb. at £7 12s. 8d. per cwt.?

Ans. £60,4,11½.

4. What cost 9cwt. 2qr. 24½lb. at £4 10s. 4½d. per cwt.?

Ans. £43,18,3¾.

5. What cost 16cwt. 2qr. 17lb. of sugar, at £2,15,11 per cwt.?

qr.	cwt.	l. s. d.	
2=	$\frac{1}{2}$)	2,15,11	
		4×4=16	
		11, 3, 8	value of 4cwt.
		4	
lb.		44,14, 8	value of 16 cwt.
14=	$\frac{1}{4}$)	1, 7,11$\frac{1}{2}$	value of 2qrs.
2=	$\frac{1}{7}$)	6,11$\frac{3}{4}$	value of 14lb.
1=	$\frac{1}{2}$)	11$\frac{3}{4}$	value of 2lb.
		5$\frac{3}{4}$	value of 1lb.

NOTE.—Here I first multiply the price by 4, and that product by 4; because 4 times 4 is equal to 16, the number of cwt. I then say—
2 qrs. is $\frac{1}{2}$ of a cwt.
14lb. is $\frac{1}{4}$ of 2qrs.
2lb. is $\frac{1}{7}$ of 14lb.
1lb. is $\frac{1}{2}$ of 2lb.

Ans. £46,11, 0$\frac{3}{4}$ val. of 16cwt. 2qr. 17lb.

6. What cost 25cwt. 3qr. 14lb. at 3£ 17s. 6d. per cwt.? *Ans.* £100,5,3$\frac{3}{4}$.

7. What cost 12cwt. 3qr. 14lb. at 2£ 10s. per cwt.? *Ans.* £32,3,9.

8. What cost 1cwt. 1qr. 8lb. at 1£ 17s. per cwt.? *Ans.* £2,8,10$\frac{1}{2}$.

9. What cost 27T. 16cwt. 3qr. 18lb. at 90£ 10s. per Ton?

cwt.	T.	£ s. d.	
10=	$\frac{1}{2}$)	90,10,0	
		9×3=27	
		814,10,0	value of 9 ton.
		3	
cwt.		2443,10,0	value of 27 ton.
5=	$\frac{1}{2}$)	45, 5,0	value of 10 cwt.
1=	$\frac{1}{5}$)	22,12,6	value of 5 cwt.
2qr.=	$\frac{1}{2}$)	4,10,6	value of 1 cwt.
1 =	$\frac{1}{2}$)	2, 5,3	value of 2 qrs.
14lb.=	$\frac{1}{2}$)	1, 2,7$\frac{1}{2}$	value of 1 qr.
2 =	$\frac{1}{7}$)	11,3$\frac{3}{4}$	value of 14 lb.
2 =		1,7$\frac{1}{4}$	value of 2 lb.
		1,7$\frac{1}{4}$	value of 2 lb.

NOTE.—I here multiply by 9, and that product by 3; because 3 times 9 is equal to 27: I then say—
10cwt. is $\frac{1}{2}$ of a T.
5cwt. is $\frac{1}{2}$ of 10cwt.
1cwt. is $\frac{1}{5}$ of 5cwt.
2qrs. is $\frac{1}{2}$ of 1 cwt.
1qr. is $\frac{1}{2}$ of 2qrs.
14lb. is $\frac{1}{2}$ of 1qr.
2lb. is $\frac{1}{7}$ of 14lb.
2lb. more is do.

Ans. £2520, 0,4$\frac{3}{4}$ value of the whole weight.

10. What cost 16T. 10cwt. 2qr. at 91£ 10s. per Ton?
Ans. £1512,0,9.

11. What cost 12cwt. 1qr. 24$\frac{1}{2}$lb. at 3£ 18s. 10d. per cwt? *Ans.* £49,2,11$\frac{1}{4}$.

12. What cost 3qr. 21lb. at 2£ 14s. per cwt.?
Ans. £2,10,7$\frac{1}{2}$.

13. What cost 7 cwt. 3qr. 16lb. at $9,58 per cwt.?

qr. Cwt.
2=$\frac{1}{2}$) 958 cents.
7,3,16

6706 value of 7 Cwt.
1=$\frac{1}{2}$) 479 value of $\frac{1}{2}$ Cwt.
14lb.=$\frac{1}{2}$) 239,5 value of $\frac{1}{4}$ Cwt.
2 =$\frac{1}{7}$) 119,7 value of 14 lb.
17,1 value of 2 lb.

$75,61,3 *Ans.*

NOTE.—Here, I first multiply the price in cents by 7, the number of Cwt.—and then say:
2qr. is $\frac{1}{2}$ of a cwt.
1 qr. is $\frac{1}{2}$ of 2 qrs.
14lb. is $\frac{1}{2}$ of 1 qr.
2lb. is $\frac{1}{7}$ of 14lb.

14. What cost 12 cwt. 7lb. at $6,34 per cwt.?
Ans. $76,47,6.

15. What cost 6 cwt. 3qr. 14lb. at $8 per Cwt.?
Ans. $55.

16. What cost 17 cwt. 3qr. 24$\frac{1}{2}$ lb. at $14 per cwt.?
Ans. $251,56,2$\frac{1}{4}$.

17. What cost 16 A. 3 R. 25 pol. at $125,50 per Acre?

R. A. cts.
2=$\frac{1}{2}$)12550
16,3,25

75300
12550
1=$\frac{1}{2}$) 6275 value of 2 roods.
20p.=$\frac{1}{2}$) 3137,5 value of 1 rood.
5 =$\frac{1}{4}$) 1568,7 val. of 20 poles.
392,1 value of 5 poles.

$2121,73,3 *Ans.*

NOTE.—Here I multiply the price in cents by the 16 acres; and then say:
2 roods is $\frac{1}{2}$ of an A.
1 rood is $\frac{1}{2}$ of 2 roods.
20 poles is $\frac{1}{2}$ of 1 rood.
5 poles is $\frac{1}{4}$ of 20 poles.

18. What cost 25 A. 2 R. 25 pol. at $29 per Acre?
Ans. $744,03, 1.

19. What cost 3 R. 26 pol. at $25 per Acre?
Ans. $22,81,2.

20. What cost 26 A. at £11 14s. per Acre?
Ans. £304,4.

SIMPLE INTEREST.

INTEREST, is a compensation, or premium allowed by the borrower, to the lender of money, &c.

It is computed at so much per cent, i. e. at so many dollars for each hundred, per annum; and in that proportion, for a greater, or less time.

The rate per cent, is limited by law.—In some states it is 6 per cent; that is, 6 dollars, for the use of 100 dollars, or 6 pounds, for the use of 100 pounds for one year. In some states, the rate is 7 per cent.

TERMS.

Principal, is the money lent.
Interest, is the rate per cent agreed on.
Amount, is the principal and interest added together.
Per cent. or *centum*, is by the hundred.
Per annum, is by the year.

TABLE.

OF ALIQUOT, OR EVEN PARTS OF TIME.

At 12 months to the year.			At 30 days to the month.		
mo.		yr.	d.		mo.
6	is	$\frac{1}{2}$	15	is	$\frac{1}{2}$
4	—	$\frac{1}{3}$	10	—	$\frac{1}{3}$
3	—	$\frac{1}{4}$	6	—	$\frac{1}{5}$
2	—	$\frac{1}{6}$	5	—	$\frac{1}{6}$
$1\frac{1}{2}$	—	$\frac{1}{8}$	3	—	$\frac{1}{10}$
1	—	$\frac{1}{12}$	2	—	$\frac{1}{15}$

To find the intermediate time, from one date to another.

RULE.

Set down the last mentioned year; the number of the months, and days; then place the first mentioned time

underneath; and subtract the first time from the last; and the remainder, will be the true intermediate time.

EXAMPLE.

What is the intermediate time, from Sept. 21st, 1817; to August 16th, 1819.

	yr.	mo.	da.	
	1819 .	7 .	16	Last mentioned time.
	1817 .	8 .	21	First mentioned time.
Intermediate time,	1 .	10 .	25	*Ans.*

NOTE.—As September, the month in the first mentioned time has but 30 days, I borrow from 30; had there been 31 days in the first mentioned month, I should have borrowed from 31.

Case 1.—*When the interest of any sum is required for one year.*

RULE.

Multiply the principal by the rate per cent. divide the product by 100; and the quotient will be the interest for one year.

Or,

Multiply the principal by the rate per cent; then cut off from the product the two right hand figures of the highest denomination; (which is the same, as dividing by 100,) and the left hand figures will be the interest in the same denomination of money, as that from which the figures were cut off.

Reduce the two right hand figures which were cut off as a remainder, to the next lower denomination; and add to the product, those figures of the same name; then cut off the two right hand figures as before, and the left hand figures, will be the interest in that denomination to which the remainder was reduced.

Proceed with the remainders, *or figures cut off*, as before directed, through all the different denominations; and the figures standing at the left hand of those cut off, will be the interest of the given sum for one year; in the several denominations, to which the remainders were reduced.

Case 2.—*When the interest of any sum is required for a greater, or less time, than one year.*

RULE.

Multiply the interest of one year, by the number of years.

For months, take the aliquot parts of a year.

For days, take the aliquot parts of a month, calling 30 days to the month.

Case 3.—*When the amount of any sum is required for a given time, and at a certain rate per cent.*

RULE.

Find the interest at the given rate, and time; then add the principal, and interest together, and their sum will be the amount.

Case 4.—*When the rate is 6 per cent. per annum, and the time even months.*

RULE.

Multiply the principal by half the number of months; cut off the two right hand figures of the product, and the left hand figures will be the interest for the given time.

Case 5.—*To calculate interest, for any number of days.*

RULE.

Multiply the principal by the number of days it has been at interest; then divide the product,
if the rate be 5 per cent, divide by 7305.
if " " 6 per cent, divide by 6087.
if " " 7 per cent, divide by 5217, and the quotient will be the interest, in that denomination of money, to which the principal was reduced.

Or, which will be sufficiently exact; cut off the two right hand figures from the divisor, and the same number from the dividend; then,
for 5 per cent, divide by 73,
for 6 per cent, divide by 60,
for 7 per cent, divide by 52; the quotient will be the answer.

NOTE.—The reason why the first mentioned numbers are taken for divisors, is; because they are the number of days, in which any sum will double, or gain 100 per cent, at those rates of interest.

To find the divisor for any rate of interest.

RULE.

Multiply the number of days in a year, by 100—divide that product, by the rate per cent; and the quotient will be the divisor, for that rate of interest.

Thus;—365¼ days in a year.
100 per cent.

Rate pr. ct. 6)36525

6087 Divisor for 6 per cent.

NOTE.—Proceed as above directed, to find a divisor for any other rate of interest.

Case 6.—*When the amount, time, and rate per cent. are given, to find the principal.*

RULE.

As the amount of $100, or £100 at the given rate and time, is to $100, or £100, so is the given sum to the principal required.

Case 7.—*When the principal, time, and amount, are given; to find the rate per cent.*

RULE.

As the product of the time, and principal, is to the interest for that time; so is $100, or £100, to the rate per cent.

Case 8.—*When the principal, rate, and amount are given, to find the time.*

RULE.

As the interest of the principal, for one year, is to one year; so is the whole interest, to the time required.

QUESTIONS.

What is Interest? How is Interest computed?
What is meant by rate per cent? What is meant by Principal?
What is here meant by amount? What is per annum?
What is per cent. or centum?
How do we find the intermediate time from one date to another?
How is the interest of any sum found for one year?
How do we find the amount of any sum?
When the rate is 6 per cent. and the time even months, how is the interest found?
How shall we proceed to find the interest on any sum, when the time is greater, or less than a year?

How is interest calculated for any number of days?

How is the principal found, when the amount, time, and rate per cent are given?

How is the rate per cent found, when the principal, time, and amount are given?

How is the time found, when the principal, rate, and amount are given?

EXAMPLES.

Case 1.—*Where the interest of a certain sum is required for one year.*

1. What is the interest of £269,15,9¾, for one year, at 6 per cent. per annum.

	£ s. d.
Principal,	269,15, 9¾
Rate per cent.	6
	£16|18,14,10½
	20
	s.3|74
	12
	d.8|98
	4
	qr.3|94
Ans.	£16,3,8¾

NOTE 1.—Here the principal is given in English Money, and multiplied by the rate per cent; the two right hand figures of pounds are then cut off, leaving £16: the remainder is then multiplied by 20 and the 14s. brought down; the two right hand figures of this product are cut off, leaving 3s.: the remainder is multiplied by 12, and the 10d. brought down into the product, the two right hand figures of which are cut off, leaving 8d.: the remainder is multiplied by 4, and the ½d. or 2qr. are added to the product, from which the two right hand figures are cut off; leaving 3qr.: the interest is therefore £16,3,8¾.

NOTE 2.—Cutting off the two right hand figures from the several products, is equal to dividing them by 100; and the figures thus cut off, the remainders.

2. What is the interest of \$563,94, for one year, at 7 per cent. per annum?

56394 Principal.
7 Rate per cent.

c.3947|58=\$39,47,5$\frac{8}{10}$ *Ans.*

NOTE.—Here the principal being Federal Money, I set it down as so many cents, and after multiplying by the rate pr. ct., I cut off the two right hand figures from the product; the left hand figures are cents; which I separate into dollars and cents; the right hand figures cut off, are decimals of a cent; equal to 5$\frac{8}{10}$ mills.

3. What is the interest of £150, for one year, at 7 per cent. per annum? *Ans.* £10,10.

4. What is the interest of $326, for one year, at 7 per cent. per annum? *Ans.* $22,82.

5. What is the interest of £270,10,6, for one year, at 5 per cent. per annum? *Ans.* £13,10,6¼.

6. What is the interest of $765,27,6, for one year, at 5 per cent. per annum?

```
  765276 mills.
        5
  ---------
m.38263|80
  ---------
$38,26,3 8/10 Ans.
```

NOTE.—Here I set down the principal, as so many mills, and multiply by the rate per cent; then cut off the two right hand figures, and the left hand figures are mills.

7. What is the interest of £11,13,4, for one year, at 4 per cent. per annum? *Ans.* £0,9,4.

8. What is the interest of $500, for one year, at 4 per cent. per annum? *Ans.* $20.

9. What is the interest of £156,17,9¾, for one year, at 7½ per cent. per annum?

```
    £   s.  d.
½)156,17,9¾
          7½
  -----------
    78, 8,10⅞
  1098, 4, 8¼
  -----------
  11|76,13, 7
      20
  ------
  15|33
     12
  ------
   4|03   Ans. £11,15,4.
```

NOTE.—Here I first take ½ of the given principal; then multiply by the integer of the rate; then add the quotient and product together; then cut off the two right hand figures from that sum, and from the product of the several denominations.

10. What is the interest of $397,67, for one year, at 7½ per cent. per annum? *Ans.* $29,82,5.

11. What is the interest of £34,16,8½, for one year, at 6 per cent. per annum? *Ans.* £2,1,9½.

12. What is the interest of $476, for one year, at 6 per cent. per annum? *Ans.* $28,56.

EXAMPLES.

Case 2.—*Where interest is required for a greater or less time than one year.*

1. What is the interest of £450,16,7½, for 3 years, at 6 per cent. per annum?

£450,16,7½	£27,0,11¾ Interest for 1 year.
6	3
27|04,19,9	*Ans.* £81,2,11¼ Interest for 3 years.
20	
0|99	
12	
11|97	
4	
3|88	

NOTE.—Here I first multiply the principal by the rate per cent. and find the interest for 1 year; which I set down, and multiply it by the number of years.

2. What is the interest of $500, for three years, at 6 per cent. per annum? *Ans.* $90.

3. What is the interest of £103,11,4, for four years, at 7½ per cent. per annum? *Ans.* £31,1,4¾.

4. What is the interest of $736,21,3, for three years, at 7 per cent. per annum? *Ans.* $154,60,4.

5. What is the interest of $647,65,4, for 4 years, 10 months, and 20 days; at 5 per cent. per annum?

	647654 mills.	
	5	
6 mo. is ½ of 1 year.=½)	3238270	mo. da.
		4 10 20
	12953080	Product, for 4 yr.
3 mo. is ½ of 6 mo.=½)	1619135	— 6 mo.
1 mo. is ⅓ of 3 mo.=⅓)	809567	— 3 mo.
15da. is ½ of 1 mo.=½)	269855	— 1 mo.
5da. is ⅓ of 15da.=⅓)	134927	— 15da.
	44975	5da.
	m.158315(39	
	$158,31,5 *Ans.*	

NOTE.—Here I multiply the principal in mills by the rate per cent, and that product by the time; then cut off the two right hand figures, and point off the left hand figures for dollars, cents and mills.

6. What is the interest of £80,12,9, for one year, and 11 months, at 6 per cent. per annum? *Ans.* £9,5,5¼.

7. What is the interest of $916,72, for 1 year and 4 months, at 6 per cent. per annum? *Ans.* $73,33,7.

8. What is the interest of $7500, for 4 months, at 7 per cent. per annum? *Ans.* $175.

9. What is the interest of £319,0,6, for five years, and 9 months; at 3¾ per cent. per annum?

	l.	s.	d.	
2qrs.=½)	319	0	6	
			3¾	
1qr. =½)	159	10	3	} = { Both of which halves
	79	15	1½	are equal to ¾ per cent.
	957	1	6	
11)	96	6	10½	

11)96 6 10½
20
19)26
12
3)22
4
90

mo.		yr.	l.	s.	d.	
6 is ½ of 1=½)			11	19	3	Interest for 1 yr.
					5	yrs.
mo.		mo.	59	16	3	Int. for 5 yrs.
3 is ½ of 6=½)			5	19	7½	Int. for 6 mo.
			2	19	9¾	Int. for 3 mo.
Ans. £			68	15	8¼	Interest for 5 yrs. and 9mo.

10. What is the interest of $150, for 5 months, at 6 per cent. per annum? *Ans.* $3,75.

EXAMPLES.

Case 3. *Where the amount of any sum is required for a given time, and at a certain rate per cent.*

1 What is the amount of $761,14, for one year, and 7 months, at 7 per cent. per annum?

Cents, 76114 Principal.
7 Rate per cent.

6 mo. is ½ of 1 yr.=½)532798 Product for 1 yr.
1 mo. is ⅙ of 6 mo.=⅙)266399 for 6 mo.
44399 for 1 mo.

Interest, 8435(96 for 1 yr. 7 mo.
Principal, 76114

Amount, cts.84549=$845,49,9 6-10 An.

NOTE.—The 96 cut off from the interest, is equal to $\frac{96}{100}$ of a cent; or $9\frac{6}{10}$ mills.

2. What will £53.9,4 amount to, in one year and 8 months; at 6 per cent per annum? *Ans.* £58,16,3.

3. What will £725,12,6, amount to, in one year, at 5 per cent. per annum? *Ans.* £761,18,1½.

4. What will $341,60 amount to, in five years and 9 months, at 7½ per cent. per annum?

Principal,	$341,60
Interest,	
Amount,	$488,91½ *Ans.*

5. What will £763,17,7½ amount to, in three years, 5 months, and 20 days; at 5¼ per cent, per annum?

£	s.	d.	
¼)763	17	7½	Principal.
		5¼	Rate per cent.
190	19	4⅞	Product of ¼ per cent.
3819	8	1½	
40|10	7	6⅜	
20			
2|07			
12			
90			
4			
3|61			

	£	s.	d.	
4mo. is ⅓ of a yr.=⅓)	40	2	0¾	In.for 1yr
			3	
	120	6	2¼	for 3yrs.
1mo. is ¼ of 4mo.=¼)	13	7	4¼	for 4mo.
15da. is ½ of 1mo =½)	3	6	10	for 1mo.
5da. is ⅓ of 15da.=⅓)	1	13	5	for 15da.
		11	1⅔	for 5da.
Interest,	£139	4	11	for 3yr.5mo.20d.
Principal,	£763	17	7½	
Amount,	£903	2	6½	*Ans.*

6. What will £89,11,6¾ amount to, from May 19th, 1816; to August 11th, 1817; at 8 per cent. per annum?

	yr.	mo.	d.	£.	s.	d.	
Last time,	1817	7	11	8	16	3¾	Interest.
First time,	1816	4	19	89	11	6¾	Principal.
Intermediate time between the two dates.	1	2	23	£98	7	10½	*Ans.*

7. What will £187,14,9 amount to, from June 11th, 1816; to October 26th, 1817; at 6 per cent. per ann.?

Ans. £203,4,5¾.

8. What is the amount of £1825, from March 4th, 1814, to March 29th, 1817; at 5 per cent. per annum?

Ans. £2105.

NOTE.—Here I multiplied by the number of days, and divided by the 7300, which was allowing only 365 days to the year.

9. What is the amount of $49,25, from March 16th, 1811, to Oct. 25th, 1817; at 7 per cent. per annum?

Ans. $72,03,2.

EXAMPLES.

Case 4.—*Where the rate is* 6 *per cent. per annum, and the time even months.*

1. What is the interest of £206,14,3¼, for 8 months, at 6 per cent. per annum?

```
£   s.  d.
206 14 3¼
        4=½ of 8mo.
-----------
8|26 17 1
  20
----
5|37
  12
----
4|45
   4
----
1|80 = £8,5,4¼ Answer.
```

NOTE.—Here I multiply by half the number of months, and cut off the two right hand figures from the several products, which produces the true interest at one operation, when the rate is 6 per cent.

2. How much is the interest of $187,25, for 16 months, at 6 per cent. per annum?

```
$187,25
      8=½ of 16 months.
-------
$14,98(00=Ans. $14,98.
```

3. What is the interest of $126,46, for 9 months; at 6 per cent. per annum? *Ans.* $5,69.

4½ is equal to ½ of 9 mo.

4. What is the interest of $267, for 2 months; at 6 per cent. per annum?

$267
1=½ of 2 mo.

$2,67 *Ans.*

5. What is the interest of £5,16,3, for 18 months; at 6 per cent. per annum? *Ans.* £0,10,5¼.

6. What is the interest of $500, for 1 month, at 6 per cent. per annum?

½ of 1 mo.=½)500

250=$2,50 *Ans.*

7. What is the interest of $100, for 2 months, at 6 per cent. per annum? *Ans.* $1.

8. What is the interest of £24,15,4½, for 10 months, at 6 per cent. per annum? *Ans.* £1,4,9.

9. What is the interest of £1136,16,8, for 21 months, at 6 per cent. per annum? *Ans.* £119,7,4.

EXAMPLES.

Case 5.—*Where interest is calculated for any number of days.*

1. What is the interest of $350,39, for 45 days; at 6 per cent. per annum?

```
Cents, 35039 Principal.
          45 Time.
      ------
      175195
     140156
     -------
6087)1576755(259 cts.
     12174      or
     -----   $2,59 Ans.
      35935
      30435
      -----
       55005
       54783
       -----
         222
```

NOTE.—Suppose the two right hand figures of the product had been cut off, and divided by 60, the answer would then be $2,62 7-10; but the true interest is $2,59.

2. What is the interest of £240, for 50 days; at 6 per cent. per annum? *Ans.* £1,19,5.

3. What is the interest of $400, for 73 days; at 6 per cent. per annum? *Ans.* $4,80.

NOTE.—This sum is worked by the double rule of three, allowing 365 days to the year.

4. What is the interest of $556,75, for 90 days; at 7 per cent. per annum? *Ans.* $9,63,5.

NOTE.—Here I cut off the two right hand figures of the product, and divide by 52.

5. What is the interest of $256, from June 1st. to Sept. 10th, inclusive; at 6 per ct. per annum? *Ans.* $4,28,9.

NOTE.—Inclusive, means here to include the first and last days mentioned in the time.

6. What is the amount of $572, for 120 days; at 5 per cent. per annum? *Ans.* $581,39,6.

EXAMPLES.

Case 6.—*Where the amount, time, and rate per cent. are given, to find the principal.*

1. What principal being put to interest for five years; will amount to $675,50, at 7 per cent per annum?

```
Principal,      100 dollars.
Rate,             7 per cent.
               ----
Interest,      $7)00 for 1 year.
Time,             5  years.
               ----
Interest,      $35   for 5 years.
Principal,     $100
               ----
               $135 Amount of $100 for 5 yrs. at 7 pr. ct.

         Amount.      $      Given sum.
Then as  $135   :   100  ::  675,50
                                100
                          ----------   $   cts.
                       135)6755000(500,37 Ans.
                           675
                           ---
                              500
                              405
                              ---
                               950
                               945
                               ---
                                 5
```

NOTE.—Here I first find the interest on $100 for 1 year, then for 5 years; I then add the principal to the interest to find their amount; I then say, as the amount of $100 for the given rate and time is to $100, so is the given sum to $500,37, the principal required.

2. What principal will amount to $890,81,7, in three years, at 7 per ct. interest per annum? *Ans.* $736,21,2.

3. What principal will amount to £1300 in ten years; at 6 per cent. interest per annum? *Ans.* £812,10.

EXAMPLES.

Case 7.—*Where the principal, time, and amount are given, to find the rate per cent.*

1. At what rate per ct. per annum, will $400, amount to $472, in three years?

$400 principal.
3 years.

1200 pro. of time and principal

$472 amount.
400 principal.

72 interest.

	Product.	Interest.	$
Then as,	1200 :	72 : :	100
		100	

1200)7200(6 per cent. Ans.
7200

2. At what rate per ct. per annum, will $500, amount to $725, in nine years? *Ans.* 5 per cent.

3. At what rate per ct. per annum, will $600, amount to $856,50, in nine years 6 months? *Ans.* 4½ per ct.

EXAMPLES.

Case 8.—*Where the principal, rate and amount are given, to find the time.*

1. In what time, will $500, amount to $605; at 7 per cent. per annum?

$500 principal.
7

$35|00 inst. for 1 yr.

$605 amount.
500 principal.

105 whole interest.

Interest for 1 year.	One yr.	Whole int.
$35 :	1 :	105
		1

35)105(3 years, Ans.
105

2. In what time, will $420, amount to $520,80; at 3 per cent. per annum? *Ans.* 8 years.

3. In what time, will $500, amount to $725; at 5 per cent. per annum? *Ans.* 9 years.

NOTES.

Where partial payments have been made.

RULE I.

On the following Note, interest is calculated on the principal, from the date of the Note, to the time of settlement, and added to the principal.

Then the interest is calculated on each payment, from the time it was made, to the time of settlement.

Then the amount of the payments, is taken from the amount of the principal;—and the remainder is the balance due.

EXAMPLE I.

A. by his Note, dated August 25th, 1817; promises to pay to B. or order, on demand with interest, at 6 per cent. £232,8,6¾.

On this note are the following payments, viz.

Received	Oct. 12th. 1817, - -	£78,1,1¾
	Oct. 13th. 1817, - -	18
	Nov. 2d. 1817, - -	60

How much was due on settlement of the note, December 15th, 1817?

Principal, - - - - -	£232,08,6¾	
Interest on do. 3 mo. and 20 days, -	4,05,2½	
Amount of principal, - - -	£236,13,9¼	
1st payment, - - - - -	£78,01,1¾	
Interest on do. 2 mo. 3 days, - -		16,4½
2nd payment, - - -	18	
Interest on do. 2 mo. 2 days, - -		3,8½
3d payment, - - - -	60	
Interest on do. 1 mo. 13 days, - -		8,7
Amount of payments; which subtract from the amount of principal.	£157,09,9¾	
Due on settlement from A. to B.	£79,03,11½	

NOTE.—Notwithstanding the preceding method of casting interest has been long practised, still it is far from being correct—for if $100 be put to interest, at 6 per cent. per annum; and $6 should be paid yearly, with the interest calculated on the principal, and payments, agreeable to the foregoing method; the creditor in less than thirty years, would be the debtor; without receiving one cent of the principal lent.

RULE II.

Interest on the following Note, is calculated agreeable to a rule established by the Superior Court of the State of Connecticut, in 1784.

Interest is calculated on the principal, from the time the Note was given, to the time of the first payment—provided the payment be made one year, or more, from the date of the Note, and the interest added to the principal—then the payment is deducted from the amount of the Note.

If there be more payments than one, proceed in the same manner from one payment to another; provided the time between one payment and another, be one year or more.

But if any payment be made before one year's interest hath accrued—then compute the interest on the principal due, for one year; and add it to the principal—then compute the interest on the sum paid, from the time it was paid, to the end of the year. i. e. up to the time interest was computed on the principal—which add to the sum paid, and deduct the amount of the payment from the amount of the principal.

If any payments should be made of a less sum than the interest arisen up to the time of such payment, then interest is not to be computed on the payment at all.

If a year (as was before observed,) should extend beyond the time of settlement; then find the amount of the principal, and payments, up to the time of settlement only.

EXAMPLE II.

A. by his Note, or Bond, dated January 1st, 1814, promises to pay to B. or order on demand, $1000, with interest, at 6 per cent.

On this obligation are the following endorsements, viz.

Received, April 1st, 1815,	-	$200
" January 1st, 1816,	-	100
" June 1st, 1817,	-	300
" September 1st, 1817,	-	400

How much would remain due, on settlement, October 1st, 1817?

Principal, - - -		$1000
Interest on principal from January 1st, 1814, to April 1st, 1815—1 yr. 3mo.		75
Amount of principal, - -		1075
First payment made April 1st, 1815. -		200
Remainder for a new principal, -		875
Interest on new principal from April 1st, 1815, to April 1st, 1816—1 year,		52,50
Amount of principal, - - -		927,50
Second payment made Jan. 1st, 1816.	$100	
Interest on payment from January 1st, to April 1st, 1816—3 mo.	1,50	
Amount of 2d payment, - -		101,50
Remainder for a new principal, -		826
Interest on new principal from April 1st, 1816, to June 1st, 1817—1 yr. 2 mo.		57,82
Amount of principal, - -		883,82
Third payment made June 1st, 1817,		300
Remainder for new principal, - -		583,82
Interest on new principal, from June 1st, 1817, to October 1st, 1817—4 mo.		11,67,6
Amount of principal, - -		595,49,6
Fourth payment made Sept. 1st, 1817,	$400	
Interest on payment from September 1st, to October 1st, 1817—1 mo.	2	
Amount of 4th payment, - - -		402
Balance due from A. to B. on settlement, October 1st, 1817,		$193,49,6

RULE III.

Interest on the foregoing or following Note is again here computed, agreeable to a rule established by the courts of law in Massachusetts, viz.

Compute the interest on the principal, from the time it commenced, to the time the first partial payment was made, (provided the payment exceeded the interest due at that time;) add the interest to the principal; then subtract the payment, from the amount of the principal; but if the payment be less than the interest due at that time, cast on the interest to the next payment, and so on, then if the two, three, or four payments, added together, be greater than the interest due on the principal up to the time the second, third, or fourth payment was made; subtract the sum of the payments, from the amount of the principal, and the remainder, will form a new principal, on which, compute the interest as before directed, to the time of the next payment, or final settlement.

EXAMPLE III.

A. by his Note, or Bond, dated January 1st, 1814, promises to pay to B. or order, on demand, $1000, with interest at 6 per cent.

On this obligation are the following endorsements, viz.

Received,	April 1st, 1815, - - -	$200
"	January 1st, 1816, -	100
"	June 1st, 1817, - -	300
"	September 1st, 1817, -	400

How much would remain due on settlement, October 1st, 1817?

Principal, - - - -	$1000
Interest on principal, from January 1st, 1814, to April 1st, 1815, = 1 yr. 3 mo.	75
Amount of principal, - - -	1075
Payment made April 1st, 1815, - -	200
Remainder for a new principal, - -	875
Interest on new principal, from April 1st, 1815, to January 1st, 1816 = 9 months.	39,37,5
Amount of principal, - - -	914,37,5

Amount of principal, brought forward, -	$914,37,5
Payment made January 1st, 1816, - -	100
Remainder for a new principal, - - -	814,37,5
Interest on new principal, from Jan. 1st, 1816, to June 1st, 1817 = 1 yr. 5 mo.	69,22,1
Amount of principal, - - -	883,59,6
Payment made June 1st, 1817, - -	300
Remainder for a new principal, - -	583,59,6
Interest on new principal, from June 1st, 1817, to Sept. 1st, 1817 = 3 months.	8,75,3
Amount of principal, - - - - -	592,34,9
Payment made Sept. 1st, 1817. - -	400
Remainder for a new principal, - -	192,34,9
Interest on new principal, from Sept. 1st, 1817, to Oct. 1st, 1817, = 1 month.	96,1
Balance due from A. to B. on settlement October 1st, 1817.	$193,31,0
Balanee due agreeable to the Connecticut rule of computing interest,	$193,49,6
Difference in favor of the creditors, casting it agreeable to Connecticut rule,	$ 18,6

NOTE.—Interest on the following Note, is computed agreeable to Rule 2nd.

4. A. by his Note dated June 1st, 1815, promises to pay to B. two years after date, $2000, with interest at 6 per cent. per annum.

On this Note, are the following endorsements.

Received,	Sept. 1st, 1815, - -	$96
"	Dec. 10th, 1815, - -	15
"	April 20th, 1816, - -	36
"	July 1st, 1816, - -	200
"	January 10th, 1817, - -	20
"	March 25th, 1817, - -	90

How much was due on the Note, June 1st, 1817; the time it became payable?

Principal, - - - -	$2000
Interest on principal from June 1st, 1815, to June 1st, 1816 = 1 yr.	120
Amount of principal, - -	2120

Amount of principal, brought forward,		$2120
1st, Payment made, Sept. 1st, 1815,	$96,00	
Interest on 1st payment, from Sept. 1st, 1815, to June 1st, 1816 = 9 mo.	4,32	
2nd Payment made Dec. 10th, 1815,	15,00	
Interest on 2nd payment, from Dec. 10th. 1815, to June, 1st, 1816 = 172 days.	00,42	
3d Payment made April 20th, 1816,	36,00	
Interest on 3d payment, from April 20, 1816, to June 1st, 1816 = 41 days,	00,24	
Amount of 1st, 2d, and 3d payments,		151,98
Remainder, for a new principal,		1968,02
Interest on principal, from June 1st, 1816, to June 1st, 1817 = 1 yr.		118,08
Amount of principal,		2086,10
4th Payment made July 1st, 1816,	$200,00	
Interest on 4th payment from July 1, 1816, to June 1st, 1817 = 11 mo.	11,00	
5th Payment made Jan. 10th, 1817,	20,00	
Interest on 5th payment, from Jan. 10th, 1817, to June 1st, 1817 = 141 d.	00,46	
6th Payment made March 25, 1817,	90,00	
Interest on 6th payment, from March 25, 1817, to June 1, 1817 = 67 days,	00,99	
Amount of 4th, 5th, and 6th, payments,		322,45
Balance due from A. to B. on settlement June 1st, 1817,		$1763,65

NOTE.—Interest on the preceding or following Note, is here computed, agreeable to Rule 3.

5.—A. by his Note, dated June 1st, 1815, promises to pay to B. two years after date, $2000, with interest, at 6 per cent.

On this Note are the following endorsements.

Received,	September 1st, 1815,	$ 96
"	December 10th, 1815,	15
"	April 20th, 1816,	36
"	July 1st, 1816,	200
"	January 10th, 1817,	20
"	March 25th, 1817,	90

How much was due on the Note, June 1st, 1817; the time it became payable?

Principal, - - -		$2000
Interest from June 1st, 1815, to Sept 1st, 1815 = 3 mo.		30
Amount of principal, - - -		2030
1st Payment, Sept. 1st, 1815, more than the interest then due,		96
New principal, - - -		1934
Interest from Sept. 1st, 1815, to July 1st, 1816, = 10 months,		96,70
Amount of principal, - - -		2030,70
2d Payment, Dec. 10th, 1815; less than the interest then due,	$ 15	
3d Payment, April 20th, 1816; less than the interest then due,	36	
4th Payment, July 1st, 1816; more than the interest then due,	200	
Amount of payments, - - -		251
New principal,		1779,70
Interest from July 1st, 1816, to March 25th, 1817 = 8 mo. 25 days,		78,60
Amount of principal, - - - -		1858,30
5th Payment, Jan. 10th, 1817, less than the interest then due,	$20	
6th Payment, March 25th, 1817, more than the interest then due,	90	
Amount of payments, - - - -		110
New principal, - - - - -		1748,30
Interest from March 25th, 1817, to June 1st, 1817 = 2 mo. 7 days,		19,52
Balance due from A. to B. on settlement, June 1st, 1817,		$1767,82
Balance due, agreeable to Connecticut rule,		1763,65
Difference in favor of the creditors casting the interest agreeable to Massachusetts rule,		$ 4,17

NOTE.—Here as in almost every case, Massachusetts rule for computing interest, will leave the greatest balance due.

6. Twelve months from date, I promise to pay to James Langdon, or order, five hundred and ninety-seven dollars, forty-six cents, with interest; value received.

City of Hartford, 15th May, 1817.

PETER WEBB, Jr.

$597,46

Received on this Note, Sept. 10th, 1817, $150
Jan. 1st, 1818, 200

What was due on this Note when it became payable; computing interest at 6 per cent. agreeable to Rule 1st?

Ans. $272,68.

7. I promise to pay to Samuel Jenks, Jr. or order, on demand, seven hundred and fifty dollars, with interest; value received.

City of New-York, 1st Jan. 1816.

SYLVESTER CARVER.

$750

Received on this Note, 15th May, 1817, $200
10th July, 1817, 10
1st Dec. 1817, 100

What was due on this Note, July 1st, 1818; computing interest at 7 per cent. agreeable to Rule 2d?

Ans. $556,76.

Philadelphia, 15th April, 1818.

8. For value received, I promise to pay to Philo Mumford, or order, on, or before the 15th day of July, 1820, two thousand, five hundred dollars with interest.

WM. WADDINGTON.

$2500

Suppose the following indorsements should be made—

Received	15th of July, 1818, -	$450
	1st November, -	75
	10th January, 1819, -	20
	10th May, - - -	500

What will be due on this note when it becomes payable; computing interest at 6 per cent. agreeable to Rule 3d?

Ans. $1707.18

COMPOUND INTEREST.

COMPOUND INTEREST is that which arises from the principal, and interest being added together; that is, when the interest on money becomes due, and not paid, it is added to the principal, and interest is calculated on this amount, as on the first principal.

To find the amount of any sum for several years, or from one stipulated time to another, &c.

RULE.

Find the simple interest of the given sum for one year, or time of payment; which add to the principal; then find the interest on that amount for the same time, and so on; still accounting the last amount as the principal, on which to cast interest for the next year, or payment.

Proceed thus through as many calculations as there are years interest, or payments required; add the last interest found to its principal; their sum will be the whole amount.

To find the Compound Interest on any sum.

RULE.

Subtract the given principal from the last amount, and the remainder will be the Compound Interest.

QUESTIONS.

What is Compound Interest?
How is the Compound Interest of any sum for several years found?

EXAMPLES.

1. What is the compound interest of £222 for four years, at 6 per cent. per annum?

£222	£222 .	0 .	0	Principal for 1st year.
6	13 .	6 .	4¾	1st year's interest.
13|32	235 .	6 .	4¾	Principal for 2d year.
20	14 .	2 .	4½	2d year's interest.
6|40	249 .	8 .	9¼	Principal for 3d year.
12	14 .	19 .	3¾	3d year's interest.
4|80	264 .	8 .	1	Principal for 4th year.
4	15 .	17 .	3¼	4th year's interest.
3|20	280 .	5 .	4¼	Amount.
	222			First principal.
	Ans. £58 .	5 .	4¼	Compound interest.

NOTE.—Here the interest is found on the principal for one year,

and added to the principal; then the interest is calculated on that sum for the second year, and added to the principal; and so on to the end of the four years:—then the first principal is taken from the amount of principal and interest; which leaves £58.5.4¼ the Compound Interest.

2. What is the compound interest of $740, for four years, at 6 per cent. per annum? *Ans.* $194.23.2.

3. What will $1333,33⅓ amount to in four years, at 6 per cent. per annum, compound interest?

$1333,33⅓
6
80.00|00

NOTE.—Here the interest is found from year to year, and added to the principal; the sum of the last principal and interest, is the amount required.

$1333.33⅓	Principal for 1st year.
80	1st year's interest.
1413.33⅓	Principal for 2d year.
84.80	2d year's interest.
1498.13⅓	Principal for 3d year.
89.88	3d year's interest.
1588.01⅓	Principal for 4th year.
95.28	4th year's interest.
Ans. $1683.29⅓	Amount.

4. What is the amount of £550.10 for 3 years, at 7 per cent. per annum, compound interest? *Ans.* £674.7.8¼.

5. What is the compound interest of $637,25, for five years, at 5 per cent. per annum? *Ans.* $176.06.

DISCOUNT.

DISCOUNT, is an allowance made for the payment of any sum of money before it becomes due, and is the difference between that sum due some time hence, and its present worth.

Present Worth, of any debt due some time hence, is such a sum, as, if put to interest, would in that time, and at the rate per cent. for which the discount is made, amount to the sum, or debt then due.

RULE.

As the amount of £100, or $100, for the given rate and time, is to £100, or $100; so is the given sum to the present worth.

When discount is required.

RULE.

Subtract the present worth from the given sum, and the remainder will be the discount.

PROOF.

Find the amount of the present worth, at the given rate and time, which amount, if the work is right, will be equal to the given sum.

QUESTIONS.

What is discount? What is present worth?
How is the present worth of any sum found?
How is the discount found? How is discount proved?

EXAMPLES.

1. What is the present worth of £268.10 for one year and five months; discounting at 6 per cent. per annum?

```
mo.   £     mo.
12 :  6 :: 17
      17
     ----
  12)102(8£
      96
      --
       6
      20
     ----
  12)120(10s.
      12
     ----
       0    Carried forward.
```

NOTE 1.—As the interest of £100 for 1 year, or 12 months, is £6—I say; as 12 months is to £6, so is 17 months to £8,10, which added to the principal, gives the amount of £100 for 17 months.

```
£100. 0 Principal.
   8.10 Interest.
 -------
£108.10 } Amount of £100
        } for 17 months.
```

```
Bro't forward.  £     s.       £        £    s.
     Then as,  108    10  :  100  : :  268   10
                20                      20
               ----                    ----
               2170                    5370
                                        100
                                      ------- Present worth.
                                 217|0)53700|0(247£. 9s. 3¾d.
                                        434          Answer.
                                        ----
                                        1030
                                         868
                                        ----
                                        1620
                                        1519
                                        ----
                                         101
                                          20
                                        ----
                                    217)2020(9s.
                                        1953
                                        ----
                                          67
                                          12
                                        ----
                                    217)804(3d.
                                        651
                                        ---
                                        153
                                          4
                                        ---
                                    217)612(2 qrs.
                                        434
                                        ---
                                        178
```

NOTE 2.—The second statement reads thus—As the amount of £100 for the given rate and time, is to £100, so is the given sum, to £247.9.3.2, the present worth.

NOTE 3.—Suppose discount had been required on the given sum at 6 per ct. per annum, I would then subtract (as below,) the present worth from the given sum, & the remainder *l.*21.0.8½ would be the discount.

```
l.268 . 10 . 0   Given sum.
  247 .  9 . 3½  Present worth.
-----------------
 l.21 .  0 . 8½  Discount.
-----------------
```

2. What is the present worth of $100 due one year hence; discounting 6 per cent. per annum ?

Ans. $94,33,9.

3. What is the present worth of $550,50, for 11 months, discounting 7 per cent. per annum ? *Ans.* $517,30,9.

4. How much ready money will discharge a note of £18, due 15 months hence; discounting 5 per cent. per annum ? *Ans.* £16,18,9¼.

5. What discount must be made for the present payment of $100, due 90 days hence, at 6 per cent. per annum? *Ans.* $1,45,7.

6. What is the present worth of $240, one half payable at 4 months, and the other half at 8 months, discount at 5 per cent. per annum? *Ans.* $234,16,2.

7. What is the present worth of £275, payable as follows, viz. $\frac{1}{2}$ at 3 months, $\frac{1}{3}$ at 6 months; and the rest at 9 months; supposing the discount to be made at 6 per cent.? *Ans.* £268,6,5$\frac{1}{4}$.

8. Bought a quantity of goods for £250 ready money, and sold them for £300 payable 9 months hence; what was the gain in ready money; supposing discount to be made at 6 per cent.? *Ans.* £37,1,7$\frac{1}{2}$.

9. What is the present worth of $1000, payable $\frac{1}{2}$ in 4 months, and $\frac{1}{2}$ in 8 months, discounting 5 per cent. per annum? *Ans.* $975,67,4.

10. What is the present worth of $4000 payable in 9 months; at 4$\frac{3}{4}$ per cent. per annnm? *Ans.* $3862,40,1.

EQUATION OF PAYMENTS.

Equation of Payments, is a rule by which a just time may be found, to pay at once, several debts due at different times, so that neither party may sustain loss.

RULE.

Multiply each payment by the time, and add the products together, then divide the sum of the products, by the sum of the payments, and the quotient will be the equated time required.

PROOF.

Find the interest of the sum payable at the equated time, and if the work be right, it will equal the interest of the several payments for their respective times, at the same rate.

QUESTIONS.

What is Equation of Payments?
What is the rule for finding the equated time?
How is equation proved?

EXAMPLES.

1. A. owes B. $760, to be paid as follows, viz. $200 in 6 months, $240 in 7 months, and $320 in 10 months; what is the equated time for the payment of the whole?

1st Payment,	200 × 6 = 1200	
2d "	240 × 7 = 1680	
3d "	320 × 10 = 3200	
Sum of the payments.	760	6080 Sum of the products.

NOTE.—Here I first multiply the payments by the time; then divide the sum of the products, by the sum of the payments; and find the equated time to be 8 months.

Then divide.
76|0)608|0(8 mo. *Ans.*
608

2. A Merchant hath owing to him £300 to be paid as follows, £50 at 2 months, £100 at 5 months, and the rest at 8 months, and it is agreed to make one payment of the whole; when must that be made? *Ans.* 6 months.

3. A, owes B, 200 dollars, whereof 40 dollars, is to be paid in 3 months, 60 dollars in 5 months, and the remainder in 10 months, at what time may the whole be paid, without any injustice to either? *Ans.* 7mo. 3da.

4. There is owing to a merchant £698 to be paid, £178 ready money, £200 at 3 months, and £320, in 8 months, I demand the equated time for the payment of the whole? *Ans.* 4½ months.

5. A man owes a certain sum of money, which is to be paid at four equal payments, viz, at 2 months, at 4 months, at 6 months, and at 8 months; but it is agreed to make one payment of the whole. Required the equated time? *Ans.* 5 months.

NOTE.—When no particular sum is given, any sum may be assumed.

TARE AND TRET.

TARE and TRET, is a rule for deducting certain allowances made by merchants, in buying and selling goods by weight.

Tare, is an allowance made for the weight of the box, bag, bale, or cask, containing the goods; it is generally so much per box, bag, bale, or cask,—so much per Cwt. —so much per cent.—or so much in the whole gross weight, called invoice tare.

Tret, is an allowance of 4lbs. in every 104lbs. for waste, dust, &c.

Cloff, is an allowance made of 2lbs. upon every 3 cwt.

Gross Weight, is the whole weight of any sort of goods, together with the box, barrel or bag which contains them.

Suttle is when part of the allowance is deducted.

Neat Weight, is what remains after all allowances are made.

Case 1.—*When the tare is so much per box, bag, &c.*

RULE.

Multiply the gross weight of each box by the number of boxes; and multiply the number of boxes by the tare per box; then subtract the weight of the boxes, from the gross weight, and the remainder will be the neat weight.

Case 2.—*When the the tare is so much in the whole gross weight.*

RULE.

Subtract the whole tare from the whole gross; and the remainder will be the neat weight.

Case 3.—*When the tare is so much per Cwt.*

RULE.

Divide the gross weight by the aliquot part or parts of a Cwt.; subtract the quotient, or sum of the quotients from the gross, and the remainder will be the neat weight.

Or,

Multiply the pounds gross by the tare per cwt. then divide the product by 112, and the quotient will be the tare.

Case 4.—*When tret is allowed with tare.*

RULE.

Find and subtract the tare as before directed; then divide the suttle (or remainder) by 26, and the quotient will be the tret; which subtract from the suttle, and the remainder will be the neat weight.

Case 5.—*When cloff is allowed with tare and tret.*

RULE.

Find and subtract the tare and tret as before directed; then divide the suttle by 168, and the quotient will be the cloff; which subtract from the suttle, and the remainder will be the neat weight.

Case 6.—*When the neat weight is given, and the gross weight is required.*

RULE.

Subtract the tare per cwt. from 112lbs. then say, as the remaining number of pounds is to 112lbs. so is the neat weight to the gross weight required.

Or,

When the neat weight, and the whole tare is given.

Add the tare to the neat, gives the gross weight.

Or,

When the neat weight and tare are given, and tret has been allowed.

Divide the pounds neat by 25, and add the quotient to the pounds neat, then proceed as before directed, to find the gross.

NOTE.—The reason why the neat weight should be divided by 25, where tret is allowed, (and neat weight to be bro't into gross,) is, because the 4lbs. allowed on every 104lbs. is the tret, and should be deducted from the 104lbs., which would leave but 100, a fourth part of which is 25; therefore a 25th part, added to the given sum, would give the suttle, on which the gross weight is required, where so much tare is allowed.

QUESTIONS.

What is tare and tret? What is tare? What is tret?
What is cloff? What is gross weight? What is suttle?
What is neat weight?
When the tare is so much per box, bag, &c.; how is the neat weight found?

How is the neat weight found, when the tare is so much in the whole gross weight?

When the tare is so much per cwt. how is the neat weight found?

How is the neat weight found, when tret is allowed with tare?

When cloff is allowed with tare and tret, how is the neat weight found?

How is the gross weight found, when the neat weight is given?

EXAMPLES.

Case 1.—*Where the tare is so much per box, bag, &c.*

1. In 8 hhds. of tobacco, each weighing 5 cwt. 1 qr. 19 lb. gross, tare 100lb. per hhd. how much neat weight?

	Cwt.	qr.	lb.		
	5	1	19 wt. per hhd.		100 Tare per hhd.
			8		8
					—— 4 cwt. qr. lb.
					28)800(28(7 0 16 tare.
	43	1	12 gross wt.		56 (28
	7	0	16 Tare.		—— —
					240 0
Ans.	36	0	24 Neat wt.		224
					——
					16

NOTE.—Here I first multiply the weight of 1 hhd. by the number of hhds., and the tare of a hhd. by the number of hhds., and reduce it to cwt.—then I subtract the whole tare, from the whole gross weight, and find the neat weight to be 36cwt. 0qr. 24lb.

2. What is the neat weight of 3 hhds. of tobacco, gross weight and tare as follows?

	Cwt.	qr.	lb.		lb.
No. 1.	10	1	12	Tare	95
2.	9	3	17		90
3.	11	0	20		100
					—— 4 cwt. qr. lb.
Gross wt.					28)285(10 (2 2 5 tare.
					28 8
Tare.					—— –
					5 2
Neat wt.	28	3	16 *Ans.*		

3. What is the neat weight of 15 casks of allum, each weighing 2cwt. 3qr. 12lb. gross, tare 21lb. per cask; and what will it amount to at $7,35 per cwt.?

Ans. Neat wt. 40cwt. 0qr. 5lb.—Value $294,32,8.

4. In 14 hhds. of tobacco, the whole weighing gross, 89 cwt. 3qr. 17lb., tare 50lb. per hhd.; how much is the neat weight? *Ans.* 83cwt. 2qr. 17lb.

EXAMPLES.

Case 2.—*Where the tare is so much in the whole gross weight.*

1. What is the neat weight of 24 casks of rice, each weighing 3cwt. 1qr. 8½lb. gross, tare in the whole, 8cwt. 3qr. 27½lb.?

Cwt.	qr.	lb.	
3	1	8½	
		4×6=24	
13	1	6	
		6	
79	3	8	whole gross wt.
8	3	27½	whole tare.
70	3	8½	neat wt.

NOTE.—As 4 times 6 is equal to 24, the No. of casks; I first multiply the weight of 1 cask by 4, and that product by 6; which gives the weight of the whole—then I subtract the whole tare, from the whole gross weight, which leaves the neat weight.

2. What is the neat weight of 15cwt. 3qr. 18lb., tare in the whole 2cwt. 2qr. 6lb. 6oz.?

Ans. 13cwt. 1qr. 11lb. 10oz. neat.

3. What is the neat weight of 5 casks of rice, weighing gross 38cwt. 2qr. 15lb., tare 1cwt. 1qr. 10lb.?

Ans. 32cwt. 1qr. 5lb. neat.

4. What is the neat weight of 4 hhds. of sugar, weighing gross as follows, viz.

	cwt.	qr.	lb.
No. 1.	14	3	19
2.	10	1	15
3.	11	2	14
4.	10	3	4
Whole gross wt.			
Tare,	5	3	24
Neat weight,	41	3	0 *An.*

NOTE.—Here the whole gross wt. is omitted; but the tare and neat weight are both set down.

EXAMPLES.

Case 3.—*Where the tare is so much per cwt.*

1. What is the neat weight of 12 bbls. of pot-ash, each weighing 4cwt. 2qr. 26lb., tare 12lb. per cwt.; and what will it amount to at \$9 per cwt.?

	cwt.	qr.	lb.	
	4	2	26	weight of each barrel
			12	
8 lb. is $\frac{1}{14}$ of cwt. $=\frac{1}{14}$)	56	3	4	weight of 12 bbls.
4 lb. is $\frac{1}{2}$ of 8 lb. $=\frac{1}{2}$)	4	0	6	add these two lines
	2	0	3	together for the tare
	6	0	9	tare.
Ans.	50	2	23	neat weight.

2 qrs. is $\frac{1}{2}$ of 1 cwt. $=\frac{1}{2}$)	\$9	Price of a cwt.
	50 . 2 . 23	weight.
	450 .	price of 50cwt.
14 lb. is $\frac{1}{4}$ of 2 qrs. $=\frac{1}{4}$)	4 . 50	—— of 2qrs.
7 lb. is $\frac{1}{2}$ of 14 lb. $=\frac{1}{2}$)	1 . 12$\frac{1}{2}$	—— of 14lb.
1 lb. is $\frac{1}{7}$ of 7 lb. $=\frac{1}{7}$)	56$\frac{1}{4}$	—— of 7lb.
1 lb. is ditto, - - -	8	—— of 1lb.
	8	—— of 1lb.
Ans.	\$456 . 34$\frac{3}{4}$	Amount.

2. What is the neat weight of 4 hhds. of tobacco, weighing gross as follows, viz.—

	cwt.	qr.	lb.
No. 1.	14	3	19
2.	11	2	13
3.	10	3	4
4.	10	1	16—tare 14lb. pr.cwt.

and what will it come to, at £3.19.9 per cwt.?

Ans. { Cwt.41.3.0 neat.
£166.9.6$\frac{3}{4}$ Am't.

3. What is the neat weight of 41cwt. 3qr. 9lb. gross, tare 20lb. per cwt.? *Ans.* 34cwt. 1qr. 12lb. 6oz.

4. What is the neat weight of 9 hhds. of madder, each weighing 8cwt. 3qrs. 14lb. gross, tare 16lb. per cwt.?
Ans. 68cwt. 1qr. 24lb.

5. A. and B. own a hhd. of sugar equally between them, weighing gross, 9cwt. 3qrs. how much sugar will each receive, allowing tare 12lb. per cwt.?
Ans. 4cwt. 1qr. $11\frac{1}{2}$lb.

EXAMPLES.

Case 4.—*Where tret is allowed with tare.*

1. What is the neat weight of 27 bags of coffee, each weighing 2 cwt. 3 qr. 17 lb. gross, tare 13 lb. per cwt., tret 4lb. per 104 lb.

Cwt. qr. lb.
2 . 3 . 17
9×3=27

26 . 0 . 13
3

8lb. is $\frac{1}{14}$ of a cwt. $=\frac{1}{14}$) 78 . 1 . 11 gross weight.

4 lb. is $\frac{1}{2}$ of 8 lb. $=\frac{1}{2}$) 5 . 2 . 10 tare at 8 lb. per cwt.
1 lb. is $\frac{1}{4}$ of 4 lb. $=\frac{1}{4}$) 2 . 3 . 5 tare at 4 lb. per cwt.
2 . 22 tare at 1 lb. per cwt.

9 . 0 . 9 tare at 13 lb. per cwt.

4 lb. in 104 $=\frac{1}{26}$) 69 . 1 . 2 suttle.
2 . 2 . 18 tret.

Ans. 66 . 2 . 12 neat weight.

2. What will 4 hhds. of sugar amount to, each weighing 11cwt. 2qr. $19\frac{1}{4}$lb. gross, tare 14lb. per cwt., at $16 per cwt., tret as usual? *Ans.* $628.57.

NOTE.—The odd ounces in the foregoing example are not computed.

3. What is the neat weight of 3 casks of rice, each weighing 3 cwt. 2 qr. gross, tare $10\frac{1}{2}$ lb. per cwt.?

Ans. 9 cwt. 2 qr. 1 lb. 12 oz.

4. What would be the neat weight of the above mentioned rice, if tret was allowed with tare?

Ans. 9 cwt. 0 qr. 16 lb. 13 oz.

5. Sold a hhd. of sugar weighing 6 cwt. gross, tare 100 lb.; tret as usual, for $82.50, what was it sold at per lb.?

Ans. 15 cents.

EXAMPLES.

Case 5.—*Where cloff is allowed with tare and tret.*

1. What is the neat weight of 4 hhds. of sugar, each weighing 12 cwt. 2 qr. 14 lb., tare 21lb. per cwt., tret 4lb. per 104 lb., and cloff 2 lb. per 3 cwt.

	cwt.	qr.	lb.		
	12	2	14		
			4		
14 lb. is $\frac{1}{8}$ of 1 Cwt.=$\frac{1}{8}$)	50	2	0		gross wt.
7 lb. is $\frac{1}{2}$ of 14 lb.=$\frac{1}{2}$)	6	1	7		Add these two lines together for the tare.
	3	0	17	8oz.	
	9	1	24	8	tare
$\frac{4}{104}=\frac{1}{26}$)	41	0	3	8	suttle.
	1	2	8	12	tret.
$\frac{2}{336}=\frac{1}{168}$)	39	1	22	12	suttle.
			26	4	cloff.
Ans.	39	0	24	8	neat weight.

2. What is the neat weight of 4689 lb. gross, tare 321 lb. tret and cloff as usual? *Ans.* 4175 lb. neat wt.

3. What is the neat weight of 16cwt. 2qr. 20lb. gross, tare 14lb. per cwt., tret and cloff as usual?

Ans. 13 cwt. 3 qr. 22 lb. 6 oz.

EXAMPLES.

Case 6.—*Where neat weight is given, and the gross weight is required.*

1. What is the gross weight of 12cwt. 3qr. 21lb., tare 14lb. per cwt.?

```
   lb.          cwt. qr. lb.
   112           12  3  21
    14 tare.      4
   ---          ---
    98 lb.       51
                 28
                ---
                429
               102
               ----
               1449 lb.
```

Note 1.—Here I subtract the 14lb. tare, from 112, the No. of lbs. in 1cwt.

Note 2.—Here I reduce the gross wt. to lbs.

```
          lb.      lb.        lb.
Now as,   98   :  112   : :  1449
                              112
                             ----
                             2898
                            1449
                           1449
                           ------
                       98)162288(1656 lb.
                          98
                          ---
                          642
                          588
                          ---
                           548
                           490
                           ---
                            588
                            588
                            ---
```

Note 3.—I now say, as 1cwt. with the tare subtracted, *which leaves* 98lb.; is to 1cwt. or 112lbs.; so is 1449lbs. the whole neat weight, to 1656lbs., or 14cwt. 3qrs. 4lb. gross weight, the answer.

```
     lb.  4  cwt. qr. lb.
28)1656(59(14  3   4 Ans.
   140  4
   ---  --
    256 19
    252 16
    --- --
      4  3
```

Note 4.—To prove the work, I set down the gross weight, and find the tare at 14 lb. per cwt., which is equal to 1-8 part; this I subtract from the gross weight, which leaves 12cwt. 3qrs. 21lb. the neat weight mentioned in the question.

	Cwt.	qr.	lb.	
Tare, 14lb. per cwt.$=\frac{1}{8}$)	14	3	4	gross wt.
	1	3	11	tare.
Proof,	12	3	21	neat wt.

2. What is the gross weight of 850lb. neat, tare 65lb., tret as usual?

```
     lb.                             lb.
  25)850(34lb. tret.                 850 neat.
     75                               34 tret.
     ---                             ---
     100                             884 suttle.
     100                              65 tare.
     ---                             --- 4 cwt. qr. lb.
                                  28)949(33(8  1  25 gro.
                                     84  32    Ans.
                                     ---  --
                                     109  1
                                      84
                                     ---
                                      25
```

NOTE.—I first find the tret, and add it to the neat weight—I then add the 65lb. tare; and find the gross weight to be 949lbs. or 8cwt. 1qr. 25lbs.

3. What is the gross weight of 8cwt. 2qr. 15¾lb. neat, tare 14lb. per cwt. *Ans.* 9cwt. 3qr. 14lb.

4. What is the gross weight of 16 cwt. 2qrs. neat, tare 21 lb. per cwt. allowing tret as usual?

Ans. 21 cwt. 0 qr. 12 lb.

FELLOWSHIP.

FELLOWSHIP, is a rule which serves to adjust the accounts of several merchants trading in partnership, so that each may have his share of the gain, or sustain his share of the loss, in proportion to his share of the joint stock.

It is of two kinds, viz. Single and Compound.

SINGLE FELLOWSHIP,

Is when the stocks of partners are employed for any certain time.

RULE.

As the whole stock in trade, is to the whole gain or loss, so is each man's particular stock, to his particular share of the gain or loss.

PROOF.

Add all the particular shares of the gain or loss together, and if the work is right, this sum will be equal to the whole gain or loss.

QUESTIONS.

What is Fellowship? How many kinds of fellowship are there?
What is Single Fellowship?
How is the gain or loss of each partner found?
How is Single Fellowship proved?

EXAMPLES.

1. Three Merchants trade in company, A. put into stock, $600, B. $400, and C. $250; they gained $500; what is the share of each partner, in proportion to his stock in trade?

A's stock, $600
B's stock, 400
C's stock, 250
whole stock, $1250

W. S.		W. G.		A.'s stock.
1250	:	500	: :	600

```
          500
          600
1250)300000(240$ A's gain.
     2500
     ----
      5000
      5000
      ----
         0
```

Note 1.—I first add the several stocks together; then say, as the whole stock is to the whole gain, so is A's stock to A's gain; which is $240.

W. S.		W. G.		B's stock.
1250	:	500	: :	400

```
          500
          400
1250)200000(160$ B's gain.
     1250
     ----
      7500
      7500
      ----
         0
```

Note 2.—Here I say, as the whole stock is to the whole gain, so is B's stock to his gain, which is $160.

Note 3.—Here I say, as the whole stock is to the whole gain, so is C's stock to his gain, which is $100.

W. S.		W. G.		C's stock.
1250	:	500	: :	250

```
          500
          250
          -----
          25000
          1000
          -----      $
1250)125000(100C's ga.
     1250
     ----
       00
```

Note 4.—To prove the work, I add the several shares together, the sum of which, is equal to the whole gain.

```
 $
240 A's ga.
160 B's ga.
100 C's ga.
---
500 whole gain.
Proof.
```

2. A. B. and C. trade in company, A. put into stock $11520, B. $4800 and C. $2880, they gained $1920; what was each man's share of the gain?

Ans. $1152 A's share.
480 B's share.
288 C's share.

3. A Bankrupt is indebted $2729, viz. to A. he owes $500,37, to B. $228, to C. $1291,23, and to D. $709,40, and his estate is worth but $2046,75; how much can he pay on the dollar; and how much will each creditor receive?

Ans. 75 cents on the dollar.

A. will receive		$375,27¾
B.	"	171
C.	"	968,42¼
D.	"	532,05

4. Two merchants traded in company; A. put into stock £75, and B. £45, they lost by trading £30; what was the loss of each?

Ans. A's loss £18,15
B's " 11,05

5. Three merchants sent a ship to sea, which together with her cargo was worth $15000, A. and B. owned each one fifth, and C. the rest; they gained $1250; how much did each one pay, and how did each one gain by the voyage?

Ans. A. paid	$3000	gained	$250
B. "	3000	"	250
C. "	9000	"	750

6. A. B. and C. trade in company, A. put in $3000, B. $2000 and C. $1000; they gained 25 per cent. on the whole stock; what was each one's share of the gain

Ans. A's. gain $750
B's. " 500
C's. " 250

7. A gentleman bequeathed his estate to his four sons in the following manner, viz. to his first son, $5000, to his second, $4500, to his third, $4500, and to his fourth

$4000. But his whole estate, after paying debts, charges, &c. amounted to but $12000, what must each son receive?

NOTE.—Say as the whole money bequeathed, is to the whole estate; so is what was bequeathed to each one, to his share of the estate.

Ans. 1st son $3333,33$\frac{1}{3}$
2d " 3000
3d " 3000
4th " 2666,66$\frac{2}{3}$

8. A widow and her two sons share a legacy of $1500, of which the widow is to have ½, the two sons ¼ each; now suppose the eldest son relinquishes his share to the widow and younger brother, to be divided between them according to their shares in the whole; what would they respectively receive?

Ans. Widow's share, $1000.
2d son's share, 500.

DOUBLE FELLOWSHIP.

DOUBLE FELLOWSHIP, is when the stocks of partners are employed unequal times.

RULE.

Multiply each man's stock by the time it was continued in trade.

Then as the sum of the products, is to the whole gain or loss; so is each man's particular product, to his share of the gain or loss.

PROOF.

Add all the particular shares of the gain or loss together, and if the work is right, this sum will be equal to the whole gain or loss.

QUESTIONS.

What is double, or compound fellowship?

How is the gain or loss of each partner found in compound or double fellowship?

How is the work proved?

EXAMPLES.

1. Three merchants traded in company; A. put in stock, \$300 for 6 months, B. \$250 for 9 months, C. \$150 for 12 months, and they gained \$350; what was each man's share?

A's S. 300	B's S. 250	C's S. 150
6 mo.	9 mo.	12 mo.
1800	2250	1800

1800
2250
1800
—— W. Gain.
5850 : 350 :: 1800
280000
35
585|0)63000|0(\$107
585
4500
4095
)40500(69 cts.
3510
5400
5265
m.
)1350(2$\frac{180}{585}$
1170
180

Answer.

$\begin{cases} 1800 = \$107,69,2\frac{180}{585} \text{ A's G.} \\ 2250 = \ \ 134,61,5\frac{225}{585} \text{ B's G.} \\ 1800 = \ \ 107,69,2\frac{180}{585} \text{ C's G.} \end{cases}$

Proof, \$350,00,0

NOTE 1.—Here I first multiply each man's stock by the time it was continued in trade, and add the several products together; I then say, as the sum of the products is to the whole gain, so is A's product to his gain, which is \$107,69,2$\frac{180}{585}$.

NOTE 2.—I next say, as the sum of the products, is to the whole gain, so is B's product to \$134, 61,5$\frac{225}{585}$ his share of the gain.

NOTE 3.—I then say, as the sum of the products, is to the whole gain, so is C's product to \$107, 69,2$\frac{180}{585}$, C's gain.

NOTE 4.—To prove the work, I add the several shares together, and find their sum equal to 350 dollars, the whole gain.

2. A. B. and C. trade in company; A. put in \$3000 for 6 months; B. \$4000 for 10 months; and C. \$2500 for 12 months; they gained \$880; how much is each man's share of the gain?

Ans. $\begin{cases} \text{A's gain \$180.} \\ \text{B's —— 400.} \\ \text{C's —— 300.} \end{cases}$

3. Four merchants traded in company; L. put in \$400 for 5 months; M. \$600 for 7 months; N. \$960 for 8 months; and O. \$1200 for 9 months; but by misfortune at sea, they lost \$750; what must each sustain of the loss?

Ans. { L's \$ $60{,}77\frac{1964}{2468}$. N's \$$233{,}38\frac{1816}{2468}$. M's $127{,}63\frac{916}{2468}$. O's $328{,}20\frac{240}{2468}$.

4. On the first of January A. began trade with \$380; and on the first of May following, he took in B. with \$270; on the first of August following, he took in C. with \$400; at the end of the year, they found there was gained \$436; what is each man's share of the gain?

Ans. { A's \$228.
B's 108.
C's 100.

5. Two merchants enter into partnership for 16 months. A. put in stock at first \$1200, at the end of 9 months \$200 more; B. put in at first \$1500, and at the expiration of 6 months, took out \$500; with this stock they gained \$772.20cts.; what was each man's part of it?

Ans. { A's part \$401.70.
B's — 370.50.

6. A. B. and C. have a pasture in common, for which they pay £30 per annum; into which A. puts 7 cows for 3 months; B. 9 cows for 5 months; and C. 4 cows for 12 months; what must each pay of the rent?

Ans. { A. must pay £5.10. $6.1\frac{5}{19}$.
B. — $11.16.10.0\frac{8}{19}$.
C. — $12.12.\ 7.2\frac{6}{19}$.

BARTER.

BARTER, is the exchanging of one commodity for another, on such terms as may be agreed on.

Case 1.—*When the quantity of one commodity is given, with its value, to find the quantity of another commodity, or the rate for selling it.*

RULE.

Find the value of the given quantity by the most concise method—then find what quantity of the other commodity, at the rate proposed, we may have for the same money.

NOTE.—Divide the value of the first by the price of the second.

Case 2.—*When the quantities of two commodities are given, and the rate of selling, to find in case of inequality, how much of some other commodity must be given to make up the deficiency.*

RULE.

Find the separate values of the two given commodities; subtract the less from the greater, and the difference will be the amount of the third commodity.

NOTE.—Divide the amount of the third commodity by the price of one, to find the quantity.

Case 3.—*When in bartering, one commodity is rated above the ready money price; to find the bartering price of the other.*

RULE.

Say, as the ready money price of the one is to its bartering price, so is the ready money price of the other commodity to its bartering price.

QUESTIONS.

What is barter?

When the quantity and price of one commodity is given; how is the quantity or price of the other commodity found?

When the quantities and prices of two commodities are given; how do we find in case of inequality, what quantity of the third commodity must be given?

When one commodity is rated above the ready money price; how do we find the bartering price of the other?

EXAMPLES.

Case 1.—*Where the quantity of one commodity is given, with its value, to find the quantity of another commodity, or the rate of selling it.*

1. How much sugar at 8 cents per lb. must be given for 4 cwt. 2qr. 21lb. of tobacco, at 10 cents per lb.?

lb. cts. cwt. qr. lb.
1 : 10 :: 4 2 21
4
—
18
28
—
165
36
—
525 lbs.
10
cts. lb. —
8 : 1 :: 5250 cents.
1
— 28 4 cwt. qr. lb.
8)5250(656(23(5 3 $12\frac{1}{4}$ *Ans.*
48 56 20
— — —
45 96 3
40 84
— —
50 12
48
—
2

Note 1.—Here I first make a statement, and find how much 4 cwt. 2qrs. 21lb. of tobacco is worth, at 10 cents per lb.; which is 5250 cents.

Note 2—I here say, if 8 cents will buy 1lb. of sugar; how much sugar will 5250 cents buy; and find it will buy 656lbs. or 5 cwt. 3qrs. $12\frac{1}{4}$ lbs.

2. How much tobacco at 10 cents per lb. must be given for 5 cwt. 3qr. $12\frac{1}{4}$lb. of sugar at 8 cents per lb.

Ans. 4 cwt. 2qr. 21lb.

3. How much tea, at 9s. 6d. per lb. must be given in barter for 156 gallons of wine, at 12s. $3\frac{1}{2}$d per gallon?

Ans. 201lb. $13\frac{54}{114}$ oz.

4. How much tea at 9s. per lb. can I have in barter for 4 cwt. 2qrs. of chocolate at 4s per lb.? *Ans.* 224lb.

5. How much brandy at $1,25 per gallon, must I give for 50 bushels of corn, at 70 cents per bushel?

Ans. 28 gal.

6. If I give 24 yards of cloth, for 5 cwt. 1qr. of sugar, at £1,18 per cwt.; what is the cloth rated at per yard?

Ans. 8s. 3$\frac{3}{4}$d.

EXAMPLES.

Case 2.—*Where the quantities of two commodities are given, and the rate of selling, to find in case of inequality, how much of some other commodity must be given to make up the deficiency.*

1. A merchant bartered 7 cwt. of rice, at 28s. per cwt. for 4 cwt. of raisins, at 6d. per lb., and paid the balance in salt, at 4s. per bushel; how much salt did he deliver?

Raisins.	Rice.
4	7
112	28
448	196s.
6	
12)2688	
224s. val. of the raisins.	
196s. value of the rice.	
4)28s. remains.	

Ans. 7 bushels of salt.

NOTE.—Here I first find the value of the rice, which is 196s.; then the value of the raisins, which is 224s.; I then subtract the value of the rice from the value of the raisins, and find there are 28s. left; which I divide by 4s. the price of a bushel of salt; and find that the merchant must deliver 7 bushels of salt, besides the rice, in order to make the trade equal.

2. A merchant bartered 41 cwt. of rice at $4,50 per cwt. for 195 bushels of salt, at 80 cents per bushel, and received the balance in cash; how much money did he receive? *Ans.* $28,50.

3. A. and B. would barter; A. delivers 40 yds. of cloth at 7s. and 4d. per yard, and receives of B. 28$\frac{1}{2}$lb. of tea, at 11s. 6d. per lb.; which must pay balance, and how much? *Ans.* A. must pay £1,14,5.

4. A. and B. barter; A. has 150 gallons of rum, at 5s. 9d. per gallon, for which B. gives 65lb. of tea, at 2s. 10d. per lb. and the balance in coffee, at 2s. 1d. per lb.; what quantity of coffee must A. receive?

Ans. 325$\frac{3}{5}$lb.

EXAMPLES.

Case 3.—*Where in bartering, one commodity is rated above the ready money price; to find the bartering price of the other.*

1. A. has oats worth 1s. 8d. per bushel ready money, but in barter he will have 2s.; B. has broadcloth worth 14s. 6d. per yard ready money; at what price ought B. to rate his broadcloth to equal A's bartering price?

```
 s.  d.               s.  d.
 1   8                14  6
12                    12
---           s.     ----
20     :      2  ::  174
                       2
                     ----  s. d. qr.
                  20)348(17 4  3⅕ Ans.
                     20
                     ----
                     148
                     140
                     ----
                       8
                      12
                     ----
                  20)96(4
                     80
                     --
                     16
                      4
                     --
                  20)64(3
                     60
                     --
                      4=⅕.
```

NOTE.—Here I reduce the ready money price of the oats, and the ready money price of the cloth to pence; then I say, as 20d. the ready money price of the oats, is to 2s. their bartering price; so is 174d. the ready money price of the cloth, to 17s. 4d. 3⅕qrs. its bartering price.

2. A. has linen worth 40 cts. per yard ready money, but in barter he will have 48 cts. per yard; B. has broadcloth worth $2 per yard, in ready money; what ought B. to rate his broadcloth per yard, to be equivalent to the bartering price of the linen? *Ans.* $2,40.

3. A. has 150 gallons of brandy, at $1,37½ per gallon ready money, but in barter he will have $1,50; B. has

linen at 44 cents per yard ready money; how must B. sell his linen per yd. in proportion to A's bartering price, and how many yds. are equal to A's brandy?

Ans. price, 48 cts.—quantity, 468¾ yds.

LOSS AND GAIN.

Loss and Gain, is a rule by which merchants are enabled to estimate their profit or loss, in buying and selling goods; and to raise or fall the price, so as to gain or lose so much per cent.

Case 1.—*To find what is gained or lost per cent.*

RULE.

See first what the gain or loss is by subtraction: then as the price it cost is to the gain or loss, so is £100, or $100 to the gain or loss per cent.

Case 2.—*To find how goods must be sold, to gain or lose so much per cent.*

Say, as £100, or $100 is to the price it cost; so is £100, or $100 with the profit added, or loss subtracted, to the gaining or losing price.

QUESTIONS.

What is loss and gain? How is the gain, or loss per cent. found?
How do we proceed to find how goods must be sold to gain or lose so much per cent.?

EXAMPLES.

Case 1.—*Where there is a certain gain or loss per cent.*

1. If I buy salt for 75 cents per bushel, and sell it again at 90 cents per bushel; what do I gain per cent.?

Sold for	90	75 : 15 :: 100
Cost	75	100
	——	——*Ans.*
	15	75)1500(20 per cent. gain.
		150
		——
		0

Note.—I first find by subtracting the cost from the selling price, that 15 cents is gained on every 75 cents laid out.

I then say, if 75 cents gain 15 cents; 100 cents will gain 20 cents, or $100 will gain $20.

2. If I buy coffee for 16 cents, and sell it for 20 cents per lb.; what is my gain per cent.? *Ans.* $25.

3. Bought tea for 4s. per lb. and sold it again at 4s. 9d. per lb.; what is the gain per cent. or in laying out £100.
Ans. £18,15.

4. A merchant bought 650 lb. of cheese, at 10 cents per lb. and sold it at 12 cents per lb.; how much did he gain in the whole, and how much per cent.?

Ans. { Whole gain $13.
Gain per cent. $20.

5. If I pay $698,33 for 30 hhds. of molasses, and sell it again for $26 per hhd.; what shall I gain per cent.?
Ans. $11,69,5.

EXAMPLES.

Case 2.—*To show how goods must be sold, to gain or lose so much per cent.*

1. If I give $15 for a cow; how must I sell her to lose 10 per cent.?

100 : 15 :: 100 } per cent.
Subtract 10 } loss.
———
90
15
———
450
90
———
1|00)13|50
———
$13,50 *Ans.*

NOTE.—Here I say; as $100 is to $15, the cost of the cow; so is $100 with the loss per cent. subtracted; to $13,50 the selling price, at 10 per cent. loss.

2. If I give $15 for a cow; how must I sell her to gain 10 per cent.? *Ans.* $16,50.

3. Bought rum at $1,25 per gallon which not proving so good as I expected, I am content to lose 18 per cent. by it; how must I sell it per gallon? *Ans.* $1,02½.

4. A merchant bought 100 yards of cloth for $300; how must he sell it per yard, to gain 25 per cent.?
Ans. $3,75.

5. Bought rum at 90 cts. per gallon, at what rate must it be sold to gain 20 per cent.? *Ans.* $1,08.

6. If 120 lb. of steel cost £7, how must I sell it per lb. to gain £15½ per cent.? *Ans.* 1s. 4d. per lb.

7. Bought 50 gallons of brandy, at 75 cts. per gallon, but by accident, 10 gallons leaked out; at what rate must I sell the remainder per gallon, to gain upon the whole prime cost, at the rate of 10 per cent.?

Ans. $1,03,1¼.

ALLIGATION MEDIAL.

Alligation Medial, teaches how to find the mean price of several articles mixed together, when the quantity, and price of each article is given.

RULE.

Find the quantity and value of the whole mixture, then say,—

As the sum of the quantities, is to their total value, so is any part of the composition to its mean price, or value.

PROOF.

Find the value of the whole mixture at the mean price, and if it agrees with the total value of the several quantities at their respective rates, the work is right.

QUESTIONS.

What does Alligation Medial teach?
What is the rule? How is the work proved?

EXAMPLES.

1. A merchant mixed 4 cwt. of sugar at $10 per cwt. 3 cwt. at $12 per cwt. and 2 cwt. at $15 per cwt.; what is 1 cwt. of this mixture worth?

Note 1.—Here I first multiply each quantity by its price, and find they all amount to $106.

	cwt.	$.		$.
	4 at	10	=	40
	3 at	12	=	36
	2 at	15	=	30
Sum of the simples.	9			106 total val.

Carried forward.

Bro't forward. now as,

```
         cwt.  $   cwt.
          9 : 106 :: 1
                1
               ---  $ cts.
           9)106(11,77 7/9
              9   Ans.
             ---
              16
               9
  $          ---
11,77 7/9   700(77
    9        63
-------      ---
$106,00 Proof. 70
              63
              --
               7
```

Note 2.—I then say, as 9 cwt. the whole weight, is to \$106 the whole cost; so is 1 cwt. to \$11,77 7/9; the value of 1 cwt. of the mixture.

Note 3.—To prove the work, I multiply the price of 1 cwt. by the number of cwt., and find the product equal to the total value.

2. A farmer mixed 19 bushels of wheat at \$1 per bushel, and 40 bushels of rye, at 66 cts. per bushel, and 11 bushels of barley, at 50 cts. per bushel; what is a bushel of this mixture worth? *Ans.* \$0,72,7 1/7.

3. A merchant mixes 16 gallons of rum, at \$1,10; 24 gallons at 90 cents, and 12 gallons, at 75 cts. per gallon; what is a gallon of this mixture worth? *Ans.* \$0,92,6.

4. A wine merchant mixes 5 gallons of Canary wine, at 8s. per gallon, 6 gallons of Malaga, at 6s. per gallon, and 4 gallons of white wine at 6s. per gallon together; what is a gallon of this mixture worth? *Ans.* 6s. 8d.

5. A refiner mixed 6lb. of gold, of 22 carats fine; with 6lb. of 20 carats fine; what is the fineness of the mixture? *Ans.* 21 carats.

ALLIGATION ALTERNATE.

Alligation Alternate, teaches, from having the price of several articles given, to find how much of each must be taken, to make a mixture, which shall bear a certain price proposed.

RULE.

If the prices of the several articles or simples, (or either of them,) be composed of different denominations, reduce them all to the lowest denomination mentioned.

Write the prices of the articles in a column under each other, the least uppermost, and so on downward as they increase in value; with a line of connection at the left hand, and the mean price at the left hand of the line.

Link each rate which is less than the mean rate, with one or more that is greater.

Take the difference between each rate and the mean rate, (whether less or more,) and set it to the right of that rate with which it is linked.

If only one number difference stand against any rate, it will be the quantity belonging to that rate; but if there be several numbers, their sum will be the quantity.

NOTE.—If all the given prices be greater, or less, than the mean rate, they must be all linked to a Cypher.

For alloy, or water, which are considered of no value, place a cypher.

Different modes of linking the rates, will produce different answers.

PROOF.

Alligation Alternate may be proved by Alligation Medial.

QUESTIONS.

What does Alligation Alternate teach?

If the prices of several articles are composed of different denominations what must be done with them?

How are the simples together with the mean rate placed, in order to be linked?

How are the rates to be linked with each other?

What is to be done with the difference between each rate and the mean price?

How is the difference found between each rate, and the mean price?

When all the given rates are greater or less than the mean price, how must they be linked?

When alloy or water is mentioned in the question, what number must be placed for them?

What does different modes of linking the rates produce?

How is Alligation Alternate proved?

EXAMPLES.

1. A merchant has several sorts of sugar, some at 14 cts. some at 13 cts. some at 11 cts. and some at 10 cts. per lb.; how much of each sort must he mix that he may sell the mixture at 12 cts. per lb.?

		Ans. cts. lb. cts.
mean rate 12	10	2 at $10\times2=20$
	11	1 at $11\times1=11$
	13	1 at $13\times1=13$
	14	2 at $14\times2=28$
		6 lb. 72 cts.

No. of lbs. 6)72cts. whole price.

Price of 1 lb. 12 cts. Proof.

NOTE.—Here I first write down the several prices, at the right of 12 cents the mean rate; beginning with the least and so on to the greatest.

I then begin with the least, or upper number, and say the difference between 10 and 12 is 2, which I place against 14 the number with which the 10 is linked; then the difference between 11 and 12 is 1, which I place against 13; then the difference between 13 and 12 is 1, which I place against 11; then the difference between 14 and 12 is 2, which I place against 10; those figures thus placed at the right of the several prices, are the number of lbs. to be taken at those prices to compose a mixture worth 12 cents per lb.

To prove the work, I multiply the several prices by the number of pounds standing against each price, and divide the sum of the products by the whole No. of pounds, and find that the value of 1 lb. of the mixture is equal to 12 cents.

2. How much tea at $1 per lb. must be mixed with some at 66 cts. and some at 50 cts. per lb.; to make the mixture worth 75 cents per lb.?

mean rate 75.	50	$25 \quad =25$	*Ans.*
	66	$25 \quad =25$	
	100	$25+9=34$	

3. It is required to mix several sorts of wine, some at 9s. some at 15s. and some at 21s. per gallon, with water,

that the mixture may be worth 12s. per gallon, how much of each sort will it take?

mean rate, 12,	0	3 gal. of water.
	9	9 — at 9s. per gal.
	15	12 — at 15s. " "
	21	3 — at 21s. " "

4. A merchant has pepper, at 3s., 2s. 1d., and 1s. 5d. per lb.; how much of each sort must he take, to sell the mixture at 2s. 4d. per lb.?

Ans. { 14 lb. at 3s.
8 — at 2s. 1d.
8 — at 1s. 5d.

5. A merchant has spices, some at 1s. 6d. per lb. some at 2s., some at 4s., and some at 5s. per lb.; how much of each sort must he mix, that the mixture may be worth, 3s. 4d. per lb.?

	1st. method. d.	2d. method	3d. method.
mean rate, 40,	18	18	18
	24	24	24
	48	48	48
	60	60	60

	4th method.	5th method.	6th method.
40	18	18	18
	24	24	24
	48	48	48
	60	60	60

7th method.

40	18
	24
	48
	60

NOTE 1.—Here, the rates or prices are linked in seven different ways; to shew that seven different answers may be obtained to the question; and by every method, a smaller, has been linked to a larger rate, than the mean rate.

1st answer.				2nd answer.				3d. answer.			
lb.		s.	d.	lb.		s.	d.	lb.		s.	d.
20	at	1	6	8	at	1	6	28	at	1	6
8	at	2	0	20	at	2	0	8	at	2	0
16	at	4	0	22	at	4	0	38	at	4	0
22	at	5	0	16	at	5	0	22	at	5	0

4th answer.	5th answer.	6th answer.
lb. s. d.	lb. s. d.	lb. s. d.
20 at 1 6	8 at 1 6	28 at 1 6
28 at 2 0	28 at 2 0	20 at 2 0
16 at 4 0	38 at 4 0	22 at 4 0
38 at 5 0	16 at 5 0	38 at 5 0

NOTE 2.—These 7 answers all differ from each other, in consequence of the rates being linked differently.

For the several methods of linking, and obtaining the several different answers; see the rule.

7th answer.
lb. s. d.
28 at 1 6
28 at 2 0
38 at 4 0
38 at 5 0

6. How much corn at 2s. 6d., at 3s. 8d., at 4s., and at 4s. 8d. per bushel, must be mixed together, that the compound may be worth 3s. 10d. per bushel?

		s. d.
Ans.	2 bus. at	2 6
	10 — at	3 8
	16 — at	4 0
	2 — at	4 8

7. A goldsmith would mix gold of 17 carats fine, with some of 18, 19, 21, and 23 carats fine, so that the compound may be 20 carats fine; what quantity of each must he take?

Ans.	3 oz. at 17 carats fine.
	1 — at 18
	1 — at 19
	3 — at 21
	3 — at 23

EXCHANGE.

EXCHANGE, is the paying or receiving the money of one place or country, for the like value in another place or country.

TERMS.

Course of Exchange, is the current price of exchange, which is sometimes above, and sometimes below par, according as money is more plenty or scarce.

Par of Exchange, is the intrinsic value of the money

of one country, compared with the money of another country.

Real Money, is a piece of metal coined; as an Eagle, a Dollar, a Dime, a Cent, &c.

Imaginary Money, is a denomination of money, used to express a certain sum, of which there is no real specie; as a pound, a shilling, a penny, a farthing, &c.

Bank Money, in some countries is finer or more pure, than that which passes current in them.

Current Money, is such as passes current among merchants, manufacturers, &c.

Agio, signifies the difference between bank money, and current money.

Usance is a certain time allowed for the payment of bills of exchange.

Grace, is an allowance of three, or more days to the time mentioned in the bill.

Case 1.—*To change bank money, into current money.*

RULE.

Say,—As 100 bank money, is to 100 current money, with the agio added, so is the given sum in bank money, to the current money required.

Case 2.—*To change current money, into bank money.*

RULE.

Say,—As 100 current money, with the agio added, is to 100 bank money, so is the given sum in current money to the bank money required.

Case 3.—*To change a certain sum, weight, or measure of one country, to the like sum, weight, or measure of another country.*

RULE.

Find what proportion a certain sum, or weight in one country, bears to the like sum, or weight of the other country.

If the given sum, or weight be of more value than a like sum, or weight in the place required.

Multiply it by the greater of the proportional numbers, and divide the product by the less, and the quotient will be the sum or weight required.

If the given sum, or weight, be of less value than a like sum, or weight in the place required.

Multiply the given sum, or weight, by the less of the proportional numbers, and divide the product by the greater and the quotient will be the sum or weight required; and of equal value with the sum or weight given.

Or,—To change the currency only of one country or state to that of another.

RULE.

Say—As the value of a dollar in the given currency, is to the value of a dollar in the currency required; so is the given sum, to its value required.

QUESTIONS.

What is Exchange? What is Course of Exchange?
What is Par of Exchange? What is Real Money?
What is Imaginary Money? What is Bank Money?
What is Current Money? What is Agio? What is Usance?
What is Grace? How is Bank Money changed to Current Money?
How is Current Money changed to Bank Money?
How is a certain sum, weight, or measure of one country changed to that of another?

Money of Account in the United States, commonly called Federal Money.

10 Mills (m.) make 1 Cent, c.
100 Cents —— 1 Dollar, $

NOTE.—Exchanges are negotiated by the Dollar.

$		s.	d.	
1	is=	4	6	Sterling.
1	=	4	8	Georgia, &c. currency.
1	=	4	10½	Irish Money,
1	=	5		Canada, &c. currency.
1	=	6		New-England, &c. currency.
1	=	7	6	New-Jersey, &c. currency.
1	=	8		New-York, &c. currency.

Money of Account in England.

4 Farthings (qrs.) make 1 Penny, d.
12 Pence ——— 1 Shilling, s.
20 Shillings ——— 1 Pound, £

NOTE.—Exchanges are negotiated by the Pound Sterling.

£.		$. c.	
1 Sterling, is	=	4 44$\frac{4}{9}$	Federal Money.
1 of Ireland,	=	4 10	——
1 of Canada, &c.	=	4	——
1 of N. England, &c.	=	3 33$\frac{1}{3}$	——
1 of N. York, &c.	=	2 50	——
1 of N. Jersey, &c.	=	2 66$\frac{2}{3}$	——
1 of S. Carolina, &c.	=	4 28$\frac{4}{7}$	——

TABLE,

Shewing the value of a dollar in the several United States, and Great Britain; and rules for exchanging the several currencies, each to the par of all the others.

NOTE.—A. stands for add, S. for subtract, M. for multiply, and D. for divide.

EXCHANGE, to	N. Eng. &c. currency.	Penn. &c. currency.	N. York, &c. currency.	S. Caro. &c. currency.	Sterling.
N. Eng. &c. currency.	Dollar, 6 s.	A. one fourth.	A. one third.	M. by 7, and D. by 9.	S. one fourth.
Penn. &c. currency.	S. one fifth,	Dollar, 7s. 6d.	A. one fifteenth.	M. by 28, and D. by 45.	M. by 3, and D. by 5.
N. York, &c. currency.	S. one fourth.	S. one sixteenth.	Dollar, 8s.	M. by 7, and D. by 12.	M. by 9, and D. by 16.
S. Caro. &c. currency.	M. by 9, and D. by 7.	M. by 45, and D. by 28.	M. by 12, and D. by 7.	Dollar, 4s. 8d.	S. one 28th.
Sterling.	A. one third.	M. by 5, and D. by 3.	M. by 16, and D. by 9.	A. one 27th.	Dollar, 4s. 6d.

Money of Account in France.

12 Deniers make 1 Sol.
20 Sols. ——— 1 Livre.

NOTE.—Exchanges are negotiated by the Livre.

A Livre is= 18½ Cents.

Money of Account in Holland.

16 Phennings make 1 Stiver.
20 Stivers —— 1 Guilder.

NOTE.—Exchanges are negotiated by the Guilder.

A Guilder is = 39 Cents.

Money of Account in Hamburgh.

12 Deniers make 1 Sol-lub.
16 Sol-lubs —— 1 Mark Banco.

NOTE.—Exchanges are negotiated by the Mark Banco.

A Mark Banco is = 33½ cents.

Money of Account in Portugal.

1000 Reas make 1 Mill-rea.

NOTE.—Exchanges are negotiated by the Mill-rea.

A Mill-rea is = $1 24 cents.

Money of Account in Spain.

34 Marvadives of plate make 1 Real of plate,
8 Reals of plate —— 1 Piastre.

NOTE.—Exchanges are negotiated by the Real of plate.

A Real of plate is = 10 cents.
A Piastre = 80 ——

Money of Account in Russia.

100 Copecs make 1 Ruble.

NOTE.—Exchanges are negotiated by the Ruble.

A Ruble is = 66 cents.

Money of Account in Bengal.

12 Pice make 1 Ana.
16 Annas — 1 Rupee.

NOTE.—Exchanges are negotiated by the Rupee.

A Rupee is = 55½ cents.

Money of Account in Madrass.

80 Cash make 1 Fanam.
36 Fanams—— 1 Pagoda.

NOTE.—Exchanges are negotiated by the Pagoda.

A Pagoda is = $1.94 cents.

Money of Account in China.

10 Cash	make	1	Canderine.
10 Canderine	"	1	Mace.
10 Mace	"	1	Tale.

NOTE.—Exchanges are negotiated by the Tale.

A Tale is = $1,48 cents.

EXAMPLES.

Case 1.—*Where Bank Money is changed into Current Money.*

1. Change $765,75 bank money, into current money, agio 3¼ per cent.

Bank Money.		Current Mon. with agio added.		Bank Money.
100	:	100	::	765,75
		3¼ agio		103¼
		103¼		19143¾
				229725
				76575
				1|00)79063|68¾(
				Cur. mon. $790,63+*Ans.*

NOTE.—Here I say, as 100 Bank money, is to 100 current money with the agio added; so is $765,75 the given sum in bank money, to $790,63, the current money required.

2. What is the value in current money, of $1000 bank money; agio $4\frac{1}{8}$ per cent. *Ans.* $1041,25.

3. Change $500 bank money, into current money; agio $5\frac{3}{8}$ per cent. *Ans.* $526,87$\frac{1}{2}$.

Case 2.—*Where Current money is changed into Bank Money.*

EXAMPLES.

1. Change $790,63 Current Money, into Bank Money; agio $3\frac{1}{4}$ per cent.

Current mon. with agio added.		Bank money		Current money.
$103\frac{1}{4}$	:	100	::	790,63
4				4
413				316252
				100

```
              $   cts.
413)31625200(765,74 Ans.
    2891     bank money.
    ----
     2715
     2478
     ----
      2372
      2065
      ----
       3070
       2891
       ----
        1790
        1652
        ----
         138
```

NOTE 1.—Here I say, as 100 current money, with the agio added, is to 100 bank money; so is $790,63 current money, to $765,74, the bank money required.

NOTE 2.—This sum is a proof of the first sum in the preceding case; as are the two following to the second and third of the same case.

NOTE 3.—Here the answer would have had 75 cents, instead of 74, if the fraction left in the sum to which this is a proof, had been reckoned in.

2. What is the value in bank money, of $1041,25, current money; agio $4\frac{1}{8}$ per cent. *Ans.* $1000.

3. Change $526,87$\frac{1}{2}$ current money, into bank money; agio $5\frac{3}{8}$ per cent. *Ans.* $500

Case 3.—*Where a certain sum or weight of one country, is changed to the like sum or weight of another country.*

1. Change £519,16,6 New-England currency of 6s. to the dollar, to English or Sterling money, of 4s. 6d. to the dollar.

	s.	d.		d.		
Sterling Money,	4	6	=	54	=	3 — its lowest terms.
N. Eng. Cur.	6	0	=	72	=	4

£	s.	d.	
519	16	6	N. Eng.
		3	
4)1559	9	6	
Ans. £389	17	4½	Ster.

Note 1—The proportion between 4s. 6d. and 6s. or 54d. and 72d. is as 3 is to 4, or ¾ its lowest terms.

Note 2.—Three being the less of the proportional numbers, I multiply by 3, and divide by 4, the greater number; because Sterling money is less in am't than N. E. currency.

Or, as the sterling money is ¼ less than the N. England currency in amount, deduct ¼ from the N. England currency, for sterling.

	£	s.	d.	
Thus;	4)519	16	6	N. Eng.
	129	19	1½	
Ans.	£389	17	4½	Sterling.

2. Change £389,17, 4½ Sterling to N. Eng. currency.

			4
3)1559	9	6	
Ans. £519	16	6	N. E. cur.

Note.—4 being the greater of the proportional numbers, I multiply by 4, and divide by 3, the less number; because N. E. currency is greater in amount than sterling money.

Or, as N. Eng. currency is $\frac{1}{3}$ greater in amount, than Sterling money; add $\frac{1}{3}$ to the sterling money for N. Eng. currency.

	£	s.	d.	
Thus; 3)	389	17	$4\frac{1}{2}$	
	129	19	$1\frac{1}{2}$	
Ans.	£519	16	6	N. Eng. currency.

3. Change £100 Sterling money, of 4s. 6d. to the dollar, to N. York currency of 8s. to the dollar.
Ans. £177,15,$6\frac{2}{3}$.

	s. d.	d.		
Sterling	4 6	= 54	= 9	
		—	—	its lowest terms.
N. York	8 0	= 96	= 16	

4. Change £177,15,$6\frac{2}{3}$ N. York currency, to sterling money. *Ans.* £100

5. Change £100 Irish Money of 4s. $10\frac{1}{2}$d. to the dollar, to New-Jersey currency of 7s. 6d. to the dollar.
Ans. £153,16,$11\frac{1}{13}$

	s.	d.	half d.		
Irish mo.	4	$10\frac{1}{2}$	= 117	= 13	
			—	—	its lowest terms.
N. Jersey,	7	6	= 180	= 20	

6. Change £153,16,$11\frac{1}{13}$ New-Jersey currency, to Irish Money. *Ans.* £100.

7. Change £100 Georgia currency of 4s. 8d. to the dollar, to Canada currency of 5s. to the dollar.

	s.	d.	d.		
Geo.	4	8	= 56	= 14	
			—	—	their lowest terms.
Can.	5	0	= 60	= 15	*Ans.* £107,2,$10\frac{2}{7}$

NOTE.—Work by the proportional parts, or add $\frac{1}{14}$ to the Georgia currency.

8. Change £107,2,$10\frac{2}{7}$ Canada currency, to Georgia currency. *Ans.* £100.

NOTE.—Work by the proportional parts—or deduct one fifteenth.

9. What is the amount of a Bill of Exchange of £115, 14,9 sterling, sold in Hartford at $1\frac{1}{2}$ per cent advance.

	£	s.	d.			£	s.	d.	
Sterl.	154	6	4		Add $\frac{1}{3}$)	115	14	9	Sterling
Adv.		$1\frac{1}{2}$ pr.ct.				38	11	7	Exchange
	77	3	2			154	6	4	Connecticut money
	154	6	4			2	6	3	Advance.
£2)	31	9	6			£156	12	$7\frac{1}{2}$	Amt. in Con. cur.
	20								

s. 6)29	3)1566
12	$522.10 Amt. in Fed. money.
d. 3)54	
4	
qr. 2)16	

NOTE.—To reduce the Connecticut currency to Federal money, I annex half the number of shillings to the pound; which is equal to multiplying by 10, or half the number of shillings in a pound; then divide that sum by 3, which is half the number of shillings in a dollar; and the $7\frac{1}{2}$d. left, are equal to 10 cents.

10. What will be the weight in American lbs. of 526 lbs. Avoirdupois in France; allowing 100 lbs. French, to be equal to 109 lbs. 8 oz. American?

lb.	oz.			
100	0	French = 1600 oz. =	200	their lowest terms.
109	8	Amer. = 1752 oz. =	219	

lbs.
526
219
4734
526
1052
2|00)1151(94

Amer. lbs. $575\frac{194}{200}$ *Ans.*

NOTE.—Here I multiply by 219, the greater of the proportional numbers; and divide by 200 the less number; because the same weight has the greater number of American lbs.

11. What will be the weight in French lbs. of $575\frac{124}{128}$ lbs. Avoirdupois in America; allowing the difference in weight—100 lb. French, equal to 109 lb. 8 oz. American.
Ans. 526 lb. French.

12. What will a bill of exchange of £500 sterling amount to, sold in New-York at $12\frac{1}{2}$ per cent advance?

NOTE.—The difference between the sterling money and its value in New-York currency, is the exchange.

	£	s.	d.	
	500	0	0	sterling.
	388	17	$9\frac{1}{4}$	Exchange.
Value at par	888	17	$9\frac{1}{4}$	N. York cur.
	111	2	$2\frac{1}{2}$	Adv. at $12\frac{1}{2}$ pr. ct.
	999	19	$11\frac{3}{4}$	Ans. in N.Y.cur.

or £1000 with the fractions that are lost.

or $2500 Federal money.

13. What will a bill of exchange of £888,17,$9\frac{1}{3}$ New-York currency, amount to, sold in London at par?
Ans. £500.

14. Change 500 Ells of England, into American yards; 100 Ells are equal to 125 yds. *Ans.* 625 yds.

15. Change $133\frac{1}{3}$ Ells of Holland, into American yards; 75 yds. are equal to 100 Ells. *Ans.* 100 yds.

EXAMPLES.

Where Federal Money is changed to other Monies.

1. Change $100, to English or Sterling Money.

$$\begin{array}{r} 9 \\ \hline 4|0)90|0 \\ \hline \text{Sterling. } £22,10 \end{array}$$

NOTE.—Here I multiply by 9, the less of the proportional numbers, and divide that product by 40; the greater number; because there is in any sum a less number of pounds sterling than dollars.

2. Change $1500, to Georgia currency. *Ans.* £350.
3. Change $2000, to Irish money. *Ans.* £487,10.
4. Change $1624, to Canada currency. *Ans.* £406.
5. Change $1475, to New-England currency.
Ans. £442.10.

6. Change \$267, to New-Jersey currency.

Ans. £100,2,6.

7. Change \$1000, to New-York currency.

Ans. £400.

8. Change \$500, to Livres of France.

Ans. $2702\frac{26}{37}$ Livres.

9. Change \$250, to Guilders of Holland.

Ans. $641\frac{1}{39}$ Guild.

10. Change \$650, to Marks Banco of Hamburgh.

Ans. $1940\frac{20}{67}$ M. Banco.

11. Change \$467, to Mill-reas of Portugal.

Ans. $376\frac{19}{31}$ Mill-reas.

12. Change \$1264, to Reals Plate of Spain.

Ans. 12640 Reals-Plate.

13. Change \$4567, to Rubles of Russia.

Ans. $6919\frac{46}{66}$ Rubles.

14. Change \$1908, to Rupees of Bengal.

Ans. $3437\frac{93}{111}$ Rupees.

15. Change \$5550, to Pagodas of India.

Ans. $2860\frac{80}{97}$ Pagodas.

16 Change \$10674, to Tales of China.

Ans. $7212\frac{6}{37}$ Tales.

EXAMPLES.

Where other Monies are changed to Federal Money.

1. Change £22,10 sterling, to Federal Money.

```
10s.=½)40
    ————
      20
     880
    ————
   9)900
    ————
     100 Ans.
```

NOTE.—Here I multiply by 40, the greater of the proportional numbers; and divide the product by 9, the less number; because there is in any sum a greater number of dollars than pounds sterling.

2. Change £350 Georgia currency, to dollars.

Ans. \$1500.

3. Change £487,10 Irish money, to dollars.

Ans. \$2000.

4. Change £406 Canada currency, to dollars.

Ans. \$1624.

5. Change £442,10 New-England currency to dollars.
Ans. \$1475.

6. Change £100,2,6 New-Jersey currency, to dollars.
Ans. \$267.

7. Change £400 New-York currency, to dollars.
Ans. \$1000.

8. Change $2702\frac{26}{37}$ livres of France, to dollars.
Ans. \$500.

9. Change $641\frac{1}{39}$ guilders of Holland, to dollars.
Ans. \$250.

10. Change $1940\frac{20}{67}$ marks banco of Hamburgh, to dollars.
Ans. \$650.

11. Change $376\frac{19}{31}$ mill-reas of Portugal, to dollars.
Ans. \$467.

12. Change 12640 reals plate of Spain, to dollars.
Ans. \$1264.

13. Change $6919\frac{46}{66}$ rubles of Russia, to dollars.
Ans. \$4567.

14. Change $3437\frac{93}{111}$ rupees of Bengal, to dollars.
Ans. \$1908.

15. Change $2860\frac{80}{97}$ pagodas of India, to dollars.
Ans. \$5550.

16. Change $7212\frac{6}{37}$ tales of China, to dollars.
Ans. \$10674.

COMPARISON OF MONEY, WEIGHTS AND MEASURES.

Comparison of *Money*, *Weights* and *Measures*, is the finding how much in one country, is equal to a given quantity in another.

RULE.

State the question, and work agreeable to the Single Rule of Three Direct.

QUESTIONS.

What is meant by comparison of Money, Weights and Measures? By what rule is the work performed?

EXAMPLES.

1. If 79 pence Connecticut currency, be worth 1 French crown; how many Connecticut pence are worth 1000 French crowns?

F.cr.	d.	F.cr.
1	79	1000
	1000	

Ans. 79000d.

NOTE.—This statement reads thus;—If 1 French crown is equal to 79 pence, 1000 crowns are equal to 79000 pence.

2. If 79000 Connecticut pence are equal to 1000 French crowns; how many French crowns are equal to 79 Connecticut pence? *Ans.* 1 French crown.

3. If 95 lb. Flemish are equal to 100 American lbs. how many American lbs. are equal to 550 lb. Flemish? *Ans.* $578\frac{18}{19}$ lb. American.

4. If 16 French ells are equal to 24 American yds. how many American yds. are equal to $85\frac{1}{3}$ ells French? *Ans.* 128 yds. American.

CONJOINED PROPORTION.

CONJOINED PROPORTION, is when the Coins, Weights, or Measures of several countries are compared in the same question; or it is joining many proportions together, and by the relation which several antecedents, (or first numbers,) have to their consequents, (or following numbers,) the proportion between the first antecedent and the last consequent is obtained; as well as the proportion between the others, in their several relations to each other.

The work may be so abridged by cutting off an equal number of cyphers, or cancelling equal quantities on both sides, as to shorten the work very materially. It may also be proved by as many statings in the Single Rule of Three, as the nature of the question may require.

TERMS.

Antecedent, is going before.
Consequent, is following after.

Case 1.—*When it is required to find how many of the first sort of coin, weight or measure, mentioned in the question are equal to a given quantity of the last.*

RULE.

Place the numbers alternately, that is, the antecedents at the left hand, and the consequents at the right, and let the last number stand on the left hand; then multiply the left hand column continually together for a dividend, and the right hand column for a divisor, and the quotient will be the answer.

Case 2.—*When it is required to find how many of the last sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the first.*

RULE.

Place the numbers alternately, beginning at the left hand, and let the last number stand on the right hand; then multiply the right hand column continually together for a dividend, and the left hand column for a divisor, and the quotient will be the answer.

QUESTIONS.

What is Conjoined Proportion?
Can the work be in any manner abridged, or proved?
What is Antecedent? What is Consequent?
Suppose it should be required to find how many of the first sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the last; how should we proceed?
Should it be required to find how many of the last sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the first; what would be the method of work?

EXAMPLES.

Case 1—*Where it is required to find how many of the first sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the last.*

1. Suppose 50 yds. of America, are equal to 50 yds. of England; and 50 yds. of England, are equal to 25 canes of Thoulouse; and 50 canes of Thoulouse, are equal to

80 ells of Geneva; and 50 ells of Geneva, are equal to 100 ells of Hamburgh: How many yards of America, are equal to 379 ells of Hamburgh?

Statement.		Abridged.	
Antecedents.	Consequents.	Ant.	Con.
50 of Amer. =	50 of Eng.	5 =	5
50 of Eng.	25 of Thou.	50	25
50 of Thou.	80 of Gena.	5	8
50 of Gena.	100 of Ham.	5	10
379 of Ham.?		379	

NOTE.—The first abridgement was made by cutting off an equal No. of Cyphers on both sides.

The second abridgement was made by cancelling or expunging the two upper numbers—then as the 2d antecedent was double to its consequent, and the 4th consequent was double to its antecedent; they were all expunged—the 2d abridgement is therefore as low as it can be made; and the work is performed accordingly.

2d. Abridgement.

5 = 8

379

8)1895(

Amt. $236\frac{7}{8}$ Ans.

2. If 20 lb. at Hartford, are equal to 24 lb. at Antwerp, and 15 lb. at Antwerp, are equal to 18 lb. at Leghorn; how many lbs. at Hartford are equal to 72 lb. at Leghorn?

Ans. 50 lb.

3. If $1 in America is equal to 54d. in England, and 60d. in England, are equal to 1 crown in France; how many American dollars are equal to 100 French crowns?

Ans. $111\frac{6}{54}$

EXAMPLES.

Case 2.—*Where it is required to find how many of the last sort of coin, weight and measure, mentioned in the question, are equal to a given quantity of the first.*

1. Suppose 50 yards of America, are equal to 50 yds. of England, and 50 yards of England, are equal to 25 canes of Thoulouse, and 50 canes of Thoulouse, are equal to 80 ells of Geneva, and 50 ells of Geneva, are equal to

100 ells of Hamburgh; how many ells of Hamburgh, are equal to $236\frac{7}{8}$ yards of America?

Statement.		Abridged.	
Antecedents.	Consequents.	Ant.	Con.
50 of Amer. =	50 of Eng.	5 =	5
50 of Eng.	25 of Thou.	50	25
50 of Thou.	80 of Gen.	5	8
50 of Gen.	100 of Ham.	5	10
	$236\frac{7}{8}$ of Amer.		$236\frac{7}{8}$

2d. Abridgement.

$5 = 8$

$236\frac{7}{8}$

5)1895

Ham. 379 Ans.

NOTE.—This case being the reverse of the first, they are proofs to each other; there need nothing more be said here as respects the manner of work, than to refer the learner to the rule for Case 2d.

2. If 20 lb. at Hartford, are equal to 24 lb. at Antwerp, and 15 lb. at Antwerp, are equal to 18 lb. at Leghorn; how many lbs. at Leghorn, are equal to 50 lb. at Hartford? *Ans.* 72 lb. Leg.

3. If $1 in America, is equal to 54d. in England, and 60d. in England, are equal to 1 crown in France; how many French crowns, are equal to $111\frac{6}{54}$ American dollars? *Ans.* 100 F. C.

ARBITRATION OF EXCHANGES.

ARBITRATION OF EXCHANGES, is a rule by which we can find the most advantageous way of remitting money from abroad; the work is performed by Conjoined Proportion.

QUESTION.

What is Arbitration of Exchanges; and the manner in which the work is performed?

EXAMPLE.

Suppose a merchant has $3530 at Amsterdam, which he can remit by way of Lisbon at 840 rees per dollar,

and from thence to Hartford, at 8s. 1d. per milree (or 1000 rees;)

Or, he can remit the $3530 by way of Nantz, at $5\frac{2}{5}$ livres per dollar, and from thence to Hartford at 6s. 8d. per crown (or 6 livres;)

The question now is, to arbitrate these exchanges, or find which is the most advantageous way to remit the money; i. e. by way of Lisbon, or by way of Nantz?

Statement by way of Lisbon.

Antecedents.		Consequents.
1 dol. at Ams.	=	840 rees at Lis.
1000 rees at Lis.		97 d. at Hart.
		3530 $. at Ams.

He would receive £1198 . 8 . $8\frac{4}{10}$d. by way of Lisbon.

Statement by way of Nantz.

Antecedents.		Consequents.
1 dol. at Ams.	=	$5\frac{2}{5}$ livres at Nantz,
6 livr. at Nantz.		80 d. at Hart.
		3530 $. at Ams.

He would receive £1059 by way of Nantz.

Now subtract the £1059 from the £1198 . 8 . $8\frac{4}{10}$d.—and the difference will be £139 . 8 . $8\frac{4}{10}$d. in favor of remitting the money by way of Lisbon, rather than remitting it by way of Nantz.

NOTE.—The statements of the foregoing question were thought sufficient for the learner, without performing the work at large; see the work of Example 1st., Case 2d., in Conjoined Proportion.

COMMISSION.

COMMISSION, is an allowance to Agents or Factors, of a certain rate per cent., for money laid out in buying or selling goods, &c. for others.

RULE.

To find the Commission at any rate per cent.; work in the same manner as in finding the interest on the same sum for one year

QUESTIONS.

What is meant by Commission? How is the Commission found?

EXAMPLES.

1. What is the commission on $2469 . 50 at 2½ per cent.?

2469 . 50	
2½	
1234 . 75	
4939 . 00	

Ans. $61.73 . 75
or, $61.73 . 7½ mills.

NOTE.—Let it be observed, that the work is performed here, precisely in the same manner as in Simple Interest.

2. What is the commission on $1974 at 4 per cent.? *Ans.* $78 . 96.

3. What is the commission on £629 . 8 . 7½ at 7¾ per cent.? *Ans.* £46 . 11 . 6¼.

4. What must I receive for goods sold on my account, to the amount of £456 . 11 . 8, allowing a commission of 2½ per cent.? *Ans.* £445 . 3 . 4½.

5. Suppose I had goods sold on my account to the amount of $936.70; what sum must I receive for them, if I allow 2½ per cent. for commission, and ¼ per cent. for prompt pay? *Ans.* $910.99.9.

NOTE.—On the above sum the commission is first found and deducted; then the ¼ per cent, is found on the remaining sum and deducted from it, which gives the answer.

BROKERAGE.

BROKERAGE, is an allowance of so much per cent. to Factors and Brokers, for assisting merchants in purchasing or selling goods.

RULE.

Brokerage as well as commission, is found in the same manner as interest for one year.

QUESTIONS.

What is Brokerage? How is the Brokerage found?

EXAMPLES.

1. What is the brokerage on $1219, at $\frac{3}{8}$ per cent.?

$$\begin{array}{r} 1219 \\ 3 \\ \hline 8)3657 \\ \hline \text{Ans. } \$4.57\frac{1}{8} \end{array}$$

NOTE.—Here I first multiply the given sum by the numerator of the per cent. brokerage, and divide the product by the denominator;—the quotient is the answer in cents, equal to 4.57\frac{1}{8}$.

2. What is the brokerage on £500.10.7, allowing 7s. per cent. i. e. 7s. for every £100? *Ans.* £1.15.0$\frac{1}{4}$.

NOTE.—To find the above answer, say; as £100 is to 7s.; so is £500.10.7, to the brokerage or answer.

3. A broker receives $1000 to lay out, after having deducted his commission of 3 per cent. how much money remains to be laid out?

$$\begin{array}{lllllll} 100 \\ \underline{\ \ 3} & & & & \$ & \text{cts.} & \text{m.} \\ 103 : & 100 & :: & 1000 : & 970 . & 87 . & 3 \text{ the } \textit{Ans.} \end{array}$$

NOTE—Here the brokerage or commission is first added to 100; then as 100 with the brokerage added is to 100; so is the money received, to the money laid out; otherwise the broker would receive brokerage on $1000, instead of $970.87.3 i. e. on $30 more than he has to lay out.

STOCKS.

STOCK, is a name given to the capital of a Banking institution, trading company, turnpike company, &c.

RULE.

The amount of purchase money for any sum in stock, can be found in the same manner as interest is found for one year; or whatever the purchase money may exceed, or fall short of 100 per cent.—so much per cent. may be added to, or subtracted from the given sum.

QUESTIONS.

What is meant by stock? How is the purchase money found?

EXAMPLES.

1. What is the amount of $1500 bank stock, at 75 per cent.

1500	or thus
75	25 = ¼)1500
———	Subtract 375
7500	———
105	Ans. $1125 as before.
———	
Ans. $1125.00	

NOTE.—The purchase money here, being 25 per cent. short of 100; and 25 being ¼ of 100; deducting ¼ from the given sum, leaves the amount of purchase money. See the second operation.

2. What is the purchase money of $2195.50 bank stock, at 125 per cent.? *Ans.* $2744.37½.

NOTE.—Here the purchase money is 25 per cent above 100, therefore adding one fourth part to the given sum, gives the purchase money.

INSURANCE.

INSURANCE, is a security or an exemption from hazard; a *writ* or *policy* to indemnify the insured against loss is obtained by the payment of a certain sum, or so much per cent. on the amount of property insured.

Principal, is the amount insured.

Premium, is the money paid for insuring.

Case 1.—*When the amount to be insured, and the rate per cent. are given, to find the premium.*

RULE.

Proceed in the same manner as in interest or commission.

Case 2.—*When it is required to find the sum, for which a policy should be taken out to cover both principal and premium.*

RULE.

Subtract the rate per cent. from 100; then say, as 100 with the rate per ct. subtracted, is to 100, so is the given principal to the policy, or sum required.

QUESTIONS.

What is Insurance? What is Principal? What is Premium?
How do we find the Premium, when the amount and rate per cent. are given?
How do we find the amount of a Policy, to cover both principal and premium?

EXAMPLES.

Case 1.—*Where the amount to be insured, and the rate per cent. are given, to find the premium.*

1. What is the premium on $5250 at 2¼ per cent.?

```
4)5250
     2¼
  -----
  10500
   1312½
  -----
Ans. $118.12½
```

NOTE.—Here I first multiply the principal by 2, then divide it by 4 for the ¼ per cent.; and find the premium to be $118.12½.

2. What is the premium on £268.17.10½ at 6½ per cent.? *Ans.* £17.9.6½.

EXAMPLES.

Case 2.—*Where it is required to find the sum for which a policy should be taken out to cover both principal and premium.*

1. For what sum must a policy be taken out to cover £500; premium at 5 per cent.?

```
100      95 : 100 :: 500
  5                 100
---                 ----
 95              95)50000(526
                    475
                    ---
                     250
                     190
                     ---
     Carried forward. 600
```

```
Bro't forward 600
              570
              ---
               30
               20
              ---
            95)600(6
               570
               ---
                30
                12
               ---
               360(3
               285
               ---
                75
                 4
               ---
               300(3
               285
               ---
                15
```

NOTE.—Here I first subtract the premium from 100; then say, as 95 is to 100, so is £500 the amount of property insured, to £526.6.3¼, the amount of the policy, to cover both principal and premium.

Ans. £526.6.3¼.

2. A merchant wishes to insure on a vessel and cargo at sea to the amount of $2880: For what sum must the policy be taken out, to cover this property, premium 19½ per cent.? *Ans.* $3577.64.

DUODECIMALS.

Duodecimals or *Cross Multiplication*, is a rule by which some artificers cast up the contents of their work.

Duodecimals are fractions of a foot, inch, or parts of an inch, &c. having 12 for a common denominator.

The denominations of duodecimals are Feet, inches, seconds, thirds, and fourths.

12 fourths (′′′′)	make	1	third ′′′.
12 thirds	——	1	second ″.
12 seconds	——	1	inch, in.
12 inches	——	1	foot, Ft.

NOTE.—As Addition, Subtraction, and Division are performed here in the same manner as in money, weights, or measures; I shall omit those rules altogether.

MULTIPLICATION OF DUODECIMALS.

Case 1.—*When the feet of the multiplier do not exceed* 12.

RULE.

Place the feet of the multiplier under the lowest denomination of the multiplicand; then multiply by each denomination of the multiplier separately, and set down the excess of twelves of the right hand number of each product, directly under that denomination of the multiplier by which the product is found, and carry the number of twelves to the product of the next higher denomination, &c.

Should there be any vacant places from the lowest denomination up to feet, supply each vacancy with a cypher.

NOTE.—Feet multiplied by feet, give feet.
Feet multiplied by inches, give inches.
Feet multiplied by seconds, give seconds,
Inches multiplied by inches, give seconds.
Inches multiplied by seconds, give thirds,
Seconds multiplied by seconds, give fourths, &c.

Case 2.—*When the feet of the multiplier exceed* 12.

RULE.

Multiply by such numbers as when multiplied together will produce the number of feet in the multiplier; then take parts for the inches, &c.

PROOF.

Reduce both the factors to inches; divide their product by 144, and the quotient will be the answer.

QUESTIONS.

What is the use of Duodecimals, or Cross Multiplication?
What are Duodecimals?
What are the denominations of Duodecimals?
When the feet of the multiplier do not exceed 12*; what is the method of work?*
When feet are multiplied by feet, &c. what are the products?
When the feet of the multiplier exceeds 12*; how is the work performed?*
How is the work proved?

EXAMPLES.

Case 1.—*Where the feet of the multiplier do not exceed* 12.

1. Multiply 5ft. 3in., by 4ft. 6in.

```
     Ft.  in.
      5 . 3
          4 . 6
    ---------
      2 . 7 . 6″
     21 . 0
    ---------
Pro. 23 . 7 . 6″
```

NOTE.—Here I multiply the 5ft. 3 in. first by 6in., which gives 2ft. 7 in., and 6 sec. I then multiply the same by 4 feet which gives 21 feet; and find the amount of the product to be 23 ft. 7 in. 6 sec.

2. Multiply 8ft. 11in., by 7ft. 10in.

Pro. 69ft. 10in. 2″.

3. How many square feet in a flag stone, 5 ft. 10 in. long, and 4 ft. 7 in. broad? *Ans.* 26ft. 8in. 10″.

4. How many solid feet in a pile of wood, 6ft. 7in. long, 3ft. 5in. high, and 3ft. 8in. wide?

Ans. 82ft. 5in. 8″ 4‴.

EXAMPLES.

Case 2.—*Where the feet of the multiplier exceed* 12.

1. Multiply 36ft. 1in. by 18ft. 8in.

```
               Ft.  in.
6 in. = ½)36 . 1
                 6 × 3 = 18
          ---------
          216 . 6
                3
          ---------
          649 . 6       Product by 18 feet.
2 in. = ⅓) 18 . 0 . 6″  Product by 6 in.
            6 . 0 . 2   Product by 2 in.
          -------------
          673 . 6 . 8   Total product, or Ans.
```

2. Multiply 64ft. 3in. 7″ by 27ft. 2in. 6″.

Pro. 1749ft. 5in. 5″ 11‴ 6⁗.

3. What is the product of 71ft. 3in. 6″ multiplied by 92ft. 1in. 7″? *Ans.* 6568ft. 2in. 10″ 6‴ 6⁗.

SUPPLEMENT TO PART SECOND.

EXERCISES IN THE FOREGOING RULES.

1. Suppose A. owes B. $798, and A. has but $638,40 to pay the demand; how much will B. receive on the dollar? *Ans.* 80 cents.

2. How many yards of carpeting, which is 2 feet 6 inches wide; will cover a floor, 27 feet long, and 20 broad? *Ans.* 72 yds.

3. A garrison of 1200 men has provisions for 9 months, at the rate of 14 ounces per day; how long will the same provisions last, should the number of men be increased to 1600? *Ans.* $6\frac{3}{4}$ months.

4. What principal will gain as much interest in 1 month, as $127 would gain in 12 months? *Ans.* $1524.

5. If 63 lb. of bread will be sufficient for 21 men, 3 days; how much will serve 7 men, 14 days? *Ans* 98lb.

6. What is the interest of £300 for 5 weeks, at 5 per cent. per annum, or 52 weeks? *Ans.* £1.8.10.

7. Reduce $\frac{246}{372}$ to its lowest terms. *Ans.* $\frac{41}{62}$.

8. Reduce $\frac{7}{8}$, $\frac{2}{3}$, $\frac{6}{7}$, and $\frac{3}{5}$, to equivalent fractions, having a common denominator. *Ans.* $\frac{735}{840}$, $\frac{560}{840}$, $\frac{720}{840}$, $\frac{504}{840}$.

9. Reduce $\frac{12410}{19}$ to a whole or mixed number. *Ans.* $653\frac{3}{19}$.

10. What is the value of $\frac{3}{17}$ of a mile? *Ans.* 1 fur. 16 pol. 2 yds. 1 ft. $9\frac{3}{17}$in.

11. Add $240\frac{6}{20}$, $+947\frac{1}{20}$, $+77\frac{17}{20}$, and $8\frac{13}{20}$ together. Amount. $1273\frac{17}{20}$.

12. From $967\frac{9}{40}$—take $568\frac{29}{40}$. Rem. $398\frac{20}{40}$ or $\frac{1}{2}$.
13. Multiply 93648 × by $\frac{7}{9}$. Pro. $72837\frac{3}{9}$.
14. Multiply 496 × by $16\frac{3}{5}$. Pro. $8233\frac{3}{5}$.
15. Multiply $914\frac{6}{7}$ × by 15. Pro. $13722\frac{6}{7}$.
16. Divide 460 ÷ by $\frac{8}{11}$. Quo. $634\frac{4}{8}$, or $\frac{1}{2}$.
17. Divide 697 ÷ by $39\frac{7}{8}$. Quo. $17\frac{153}{319}$.
18. Divide $1819\frac{5}{6}$ ÷ by 12. Quo. $151\frac{47}{72}$.

19. Add 267,97+4,263+,2291+and 23,6 together.
Am't. 296,0621.

20. From 269,5—take 46,2671. Rem. 214,2329.

21. What is the product of ,26,21 × multiplied by 2,967 ? *Ans.* 77,76507.

22. Multiply 267×by ,25. Pro. 6675.

23. Divide 32.267÷by 2.36. Quo. 13,6+.

24. Divide .4068÷by 16. Quo. .0254+

25. What is the quotient of 4.397 divided by .368 ?
Quo. 11.948+

26. Divide 28. by ,569. Quo. 49.209+

27. What is the quotient of .816 divided by 76 ?
Ans. .010+

28. What is the quotient of .8 divided by 67 ?
Ans. 0011+

29. Divide 467 by 100. Quo. 4.67.

30. What is the value of .547 of a pound ?
Ans. 10s. 11d. 1qr.

31. What is the proper quantity of .96 of a Cwt. ?
Ans. 3qrs. 23lb. 8oz. 5dr.+

32. Reduce $\frac{3}{5}$ to a decimal. *Ans.* .6.

33. Reduce 14s. 6d. 3qrs. to the decimal of a pound.
Ans. .7281+

34. Reduce $67.19 to mills. *Ans.* 67190.

35. Reduce 4679 mills to dollars. *Ans.* $4,67,9.

36. What cost 219½ yards of cloth, at $3,14,4. per yd. ?
Ans. $690,10,8.

37. What cost 967 yards at 3qrs. per yard ?
Ans. £3,0,5¼.

38. What is the value of 1000 lbs. at 2½d. per lb. ?
Ans. £10,8,4.

39. What cost 326 yards at 1s. 1½d per yard.
Ans. £18,6,9.

40. What cost 637½ yards at 6s. 8d. per yard ?
Ans. £212,10.

41. What cost 410 yards at 13s. 9d. per yard ?
Ans. £281,17,6.

42. What cost 46½ yards at 25s. 6d. per yard ?
Ans. £59,5,9.

43. What will 234 cwt. of sugar come to at £4 per cwt.? *Ans.* £936.

44. What cost 369¼ yards at £3,17,6 per yard? *Ans.* £1430,16,10½.

45. What cost 76 yards, at 16s. per yard? *Ans.* £60,16.

46. What cost 7 cwt. 3qr. 20 lb. at £2,17,6½ per cwt.? *Ans.* £22,16,2¼.

47. What cost 21 acres, 3 roods, 30 poles of land, at $16,75 per acre? *Ans.* $367,45.

48. What is the interest of $469,56 for 1 year, at 6 per cent. per annum? *Ans.* $28,17,3.

49. What is the interest of £96,14,10½ for one year, at 7 per cent per annum? *Ans.* £6,15,5¼.

50. What will $449,19 amount to in 4 years, at 5 per cent. per annum? *Ans.* $539,02,8.

51. What will £27,16,4¾ amount to in 3 yr. 7½ months, at 7½ per cent. per annum? *Ans.* £35,7,7½.

52. How much is the interest of $964,10 for 10 months; at 6 per cent. per annum? *Ans.* $48,20,5.

53. How much is the interest of £910,11,5¼, for 22 months; at 7 per cent per annum? *Ans.* £116,17,1¼.

54. What is the interest of $918,04 for 93 days; at 7 per cent. per annum? *Ans.* $16,36,5.

55. What is the interest of £408,9,8¾ for 48 days; at 6 per cent. per annum? *Ans.* £3,4,5.

NOTE.—Multiply by 6 and 8; then divide by 6087; the quotient is the answer.

56. What principal will amount to $597 in 4 years; at 6 per cent. per annum? *Ans.* $481,45,1.

57. What principal will amount to £411,14 in 7½ years; at 7 per cent. per annum? *Ans.* £269,19,4.

58. At what rate per cent. per annum, will $400 amount to $600 in 8 years? *Ans.* 6¼ per cent.

59. In what time will $1000 amount to $1500, at 7 per cent. per annum? *Ans.* 7⅐ yr.

60. What will $1000 amount to in 3½ years, at 6 per cent. per annum, compound interest? *Ans.* $1226.74.

61. What is the present worth of $1500 due $2\frac{1}{2}$ years hence, discounting 6 per cent per annum?

Ans. $1304,34,7.

62. What discount must be made for the present payment of $500, due 120 days hence, at 6 per cent per annum? *Ans.* $9,66.

63. Suppose A. owes B. $1000, payable as follows, viz. $250 in 3 months, $250 in 6 months, and $500 in 9 months; what is the equated time for the payment of the whole? *Ans.* 6 mo. $22\frac{1}{2}$da.

64. What is the neat weight of 4 hhds. of sugar, each weighing 12 cwt. 2 qrs. 14 lb., tare 21 lb. per cwt.

Ans. 41 cwt. 0 qrs. 3 lb. 8 oz.

65 What will be the cost of 6 hhds. of Tobacco, each weighing 7 cwt. 3 qrs. 14 lb., tare $12\frac{1}{2}$ per cent.; at $13,50 per cwt. *Ans.* $558,$13\frac{3}{4}$.

NOTE.—The above answer is obtained without reckoning odd ounces or mills.

66. Suppose a legacy of $10,000 is left to be divided between a widow, her two sons, and a daughter, in the following manner, viz. the widow to have one fifth, the eldest son double to the youngest, and the remainder divided equally between the youngest son, and daughter, what is the share of each?

Ans.	Widow's	$2000
	Eldest son's	4000
	Youngest son's	2000
	Daughter's	2000

67. A, B, and C, bought the wood standing on 5 acres of land; of which A took 45 cords, B. 150 cords, and C. 75 cords: now as the price of the whole wood was $120, what must each one pay.

Ans.	A.	$20
	B.	66,$66\frac{18}{27}$.
	C.	33,$33\frac{9}{27}$.

68. How much brandy at $2,50 per gallon, must be given for 1 chest of tea, weighing 156 lbs. at $1,30 per lb.? *Ans.* $81\frac{3}{25}$ gal.

69. A merchant bartered 7 cwt. 2 qr. of sugar, at $12,50 per cwt. for 150 bushels of salt at $1,$12\frac{1}{2}$ per

bushel, and paid the balance in molasses, at $62\frac{1}{2}$ cents per gallon; how much molasses did he deliver? *Ans.* 120 gal.

70. A. has a horse worth \$75, but in barter he will have \$80; B. has oats worth 30cts. a bushel; at what price ought B. to rate his oats to equal A's bartering price? *Ans.* 32 cts.

71. If a merchant buys coffee for 18 cents per lb. and sells it again for 22 cents; what does he gain per cent.? *Ans.* $22\frac{2}{9}$ per cent.

72. If a merchant buys rum for \$1,08 per gal. how must he sell it to gain 15 per cent.? *Ans.* \$1,24,2.

73. If a merchant mixes 10 gallons of wine at 6s. per gal. 7 gal. at 8s. per gal. and 14gal. at 15s. per gal. together; what is a gallon of the mixture worth? *Ans.* 10s. 6d.

74. A merchant has spices at 20 cts. 28 cts. 40 cts. and 46 cts. per lb.; how much of each sort must he take, to sell the mixture at 34 cts per lb.

Ans. { 12 lb. at 20 cts.
6 lb. at 28 cts.
6 lb. at 40 cts.
14 lb. at 46 cts. }

75. How much bank money is equal to \$100 current money, agio $4\frac{1}{2}$ per cent.? *Ans.* \$95,69,3.

76. How much current money, is equal to \$500 bank money, agio $\frac{1}{4}$ per cent.? *Ans.* \$501,25.

77. What will be the weight in France, of 240lb. Avoirdupois in America? *Ans.* $219\frac{39}{219}$lb.

NOTE.— { French. American.
100lb. = $109\frac{1}{2}$lb. }

78. What will a bill of exchange on New-York, for \$1000, amount to in Liverpool at 10 per cent discount? *Ans.* £202,10.

79. Change £100 Sterling, to Pennsylvania currency. *Ans.* £166,13,4.

80. Change 1000 Rubles of Russia, to dollars. *Ans.* \$660.

81. If 16 French ells are equal to 24 American yards; how many American yards are equal to 100 ells French? *Ans.* 150 yds.

82. If 20lb. at Charleston, are equal to 24lb. at Antwerp, and 15lb. at Antwerp, are equal to 18lb. at Leghorn; how many lbs. at Charleston are equal to 288lb. at Leghorn? *Ans.* 200lb.

83. If 20lb. at Charleston, are equal to 24lb. at Antwerp, and 15lb, at Antwerp are equal to 18lb. at Leghorn; how many lbs. at Leghorn are equal to 200lb. at Charleston? *Ans.* 288lb.

84. Suppose a Merchant has $1765 at Amsterdam, which he can remit home by way of Lisbon at 840 rees per dollar, and from thence to Boston, at 8s. 1d. per milree (or 1000 rees;)

Or, he can remit them by way of Nantz, at 5⅗ Livres per dollar, and from thence to Boston, at 6s. 8d. per crown (or 6 livres;) which is the most advantageous way to remit the money, i. e. by way of Lisbon or by way of Nantz?

Ans. { £69.14.4¼d. in favor of remitting it by way of Lisbon.

85. My commission merchant sells goods for me to the amount of $1000; what sum must I receive for them, allowing 2 per cent. for commission, and 1½ per cent. for prompt pay? *Ans.* $965,30.

86. My broker receives from me $2000 to lay out, after having deducted his commission of 2¼ per cent.; what amount in goods must I receive? *Ans.* $1955,99.

87. What is the purchase money of $8000 bank stock at 95 per cent.? *Ans.* $7600.

88. What is the premium on $750 at 1¾ per cent? *Ans.* $13.12½.

89. For what sum must a policy be taken out to cover $1500; premium 12 per cent.? *Ans.* $1704.54.5.

90. Multiply 11ft. 4in. 3″, by 5ft. 2in.

Ans. 58ft. 7in. 11″ 6‴

NECESSARY FORMS.

BILLS OF PARCELS.

Hartford, 19*th Aug*. 1818.

1. Mr. James Spooner,

Bo't of William Wardell.

1 ps.	Linen, 26 yards, -	at $0,75		$19,50
2¼ yds.	Broadcloth, -	"	11,50	25,87½
3 —	Cassimere, -	"	4,25	12,75
¾ —	Silk Vesting, -	"	3,50	2,62½
	Rec'd Pay't.			$60,75

WILLIAM WARDELL.

Note.—See if this Bill is right.

Providence, 1*st Nov*. 1818.

2. Mr. Thomas Gould,

Bo't of Peter Brown.

15 chests Young Hyson Tea.

	lbs.			
wt.	1768			
Tare 12½ per cent,	221			
	1547 lbs.	at $1,19		$1840,93
10 rolls Nankeen = 100 ps.		at	92	92
Rec'd Payment,				$1932,93

PETER BROWN.

Note.—See if this Bill is right.

BOOK DEBT.

Mr. Thomas Jones, to Joel Jones, Jr. Dr.

1817. Jan'y 6	For	2 bbls Flour,	at	$10,25	—	$20,50
17.	—	14 lb. Sugar,	"	13	—	1,82
Nov. 1.	—	½ quintal Fish,	"	3,50	—	1,75
1818 May 25.	—	9 lb. Loaf Sugar,	"	21	—	1,89
31.	—	4 lb. Coffee,	"	27	—	1,08
		Errors excepted.				$27,04

Bennington 4th. July, 1818.

Note.—See if the several items of this Account, and the footing is right.

INVOICE.

Boston, 5th April, 1818.

Mr. WILLIAM WOODBRIDGE,

Bo't of SAM'L. DAVENPORT.

10 hhds. Rum, viz.

	Gal.	Ullage*		Gal.	Ullage.
No. 48.	114 —	8	No. 84.	116 —	12
58.	110 —	9	88.	105 —	10
61.	111 —	7	92.	108 —	3
64.	109 —	5	93.	118 —	13
71.	105 —	6	97.	103 —	7
	549	35		550	45
	35			45	
	514			505	
	505				

1019 gal. - - - at $1,05 $1069,95

2 hhds. Molasses viz.

No. 15.	107 —	8
24.	118 —	11
	225	19
	19	

206 gal. - - - - at $0,62½ $128,75

Rec'd Pay't by Note, at 90 days. $1198,70

for SAM'L. DAVENPORT.

JAMES DAVENPORT.

NOTE.—See if this Invoice is right.

* Ullage, is what a cask wants of being full.

ACCOUNT CURRENT.

Dr. Mr. WILLIAM GOODRICH, in account current with SAMUEL G. GIBBS. Cr.

1818.					1818.				
Jan.	12.	To 1000 bus. Salt,	at $0,83	$830,00	Jan.	16.	By 600 bus. Wheat,	at $1,54	$924,00
"	27.	— 25 bbls. Shad,	" 8,50	212,50	May	9.	— 500 — Rye,	" 97	485,00
Feb'y.	1.	— 215 gal. Brandy,	" 2,62½	564,37½	June,	1.	— 250 — Corn,	" 75	187,50
Mar.	19.	— 117 — Gin, -	" 87½	102,37½	July,	18.	— Cash to balance	- -	1336,75
May	2.	— 100 lb. Coffee,	" 23	23,00					
June	8.	— 28 bbls. Pork,	" 18,25	511,00					
July	10.	— 50 —— Shad	" 12,50	625,00					
"	15.	— 20 quin. Fish,	" 3,25	65,00					
				$2933,25					$2933,25

Errors excepted

Washington, July 18th, 1818.

For SAML. G. GIBBS,

WM. JONES.

NOTE.—Finish this account current, and see if the footing, and cash to balance is right.

NOTES.

1. *PROMISSORY NOTE.*

$639. *New-London, May 1st*, 1818.

For value received, I promise to pay to Theophilus Turner, six hundred and thirty-nine dollars, on demand with interest. JONATHAN WELLS.

Suppose the above Note should not be paid until the 15th Jan. following, what would it amount to, at 6 per cent.? *Ans.* $666,15½.

2. *NEGOTIABLE NOTE.*

Six months from date I promise to pay to Noah Peabody, or order, one thousand five hundred and twenty-seven dollars ninety-four cents, with interest, value received.

City of New-York 4th July, 1818.

$1527.94. WM. P. WADDINGTON.

How much will *Wm. P. Waddington* have to pay for his Note when it becomes due at 7 per ct. per annum? *Ans.* $1581,41,7.

AN ORDER.

SIR, *Newport*, 13*th Aug.* 1818.

Please to deliver to Mr. Jacob Johnson, thirty dollars worth of Goods out of your store, and charge to account of

$30. Your humble servant,

Mr Jonas Porter. THEOPHILUS HART.

RECEIPT IN PART OF A NOTE.

Received of Edmund Clark, one hundred and fifty dollars, to be endorsed on his Note of $500, payable on the 1st instant.

Alexandria, 30*th June*, 1819.

HEMAN BRADLEY.

A DRAFT.

$750. *Northampton, 29th May,* 1818.

Thirty days after date, pay to NATHANIEL B. GOODRICH, or order, seven huudred and fifty dollars, value received, and place to account of

Your Hble. servt.

PETER ARMSTRONG.

Messrs. *John P. Dodd & Co.* Merchts.

New-York.

BILL OF EXCHANGE.

Baltimore, 10*th May,* 1818.

Exchange, for £3000 Sterling.

At thirty days sight of this first of Exchange, (second and third, of the same tenor and date not paid,) pay to LEVI P. ELLSWORTH, or order, three thousand pounds sterling, valué received, and place the same to account of

Your Hble. servt.

NORMAND WASHINGTON.

Messrs. *John Duncan & Co.* Merchants,

London.

RECEIPT IN FULL OF ACCOUNTS.

$57,23.

Received of JAMES LATTIMER, fifty-seven dollars, twenty-three cents in full of all accounts.

BENJAMIN TRYON.

Wilmington, 9*th Jan.* 1818.

APPENDIX.

ADDITION OF VULGAR FRACTIONS.

RULE.

Reduce compound fractions to simple ones, and all to the same integer and denominator, if they be different; then add all the numerators together, and set the sum over the common denominator, for the sum of the fractions required.

Note.—When several fractions are to be collected, it is commonly best first to add those two together which most easily reduce to a common denominator, then their sum and a third, and so on.

EXAMPLES.

1. What is the sum of $\frac{5}{8}$, $7\frac{1}{2}$ and $\frac{1}{3}$ of $\frac{3}{4}$?
$\frac{5}{8} + 7\frac{1}{2} + \frac{1}{3}$ of $\frac{3}{4} = \frac{5}{8} + 7\frac{1}{2} + \frac{1}{4} = \frac{5}{8} + 7\frac{4}{8} + \frac{2}{8} = 7\frac{11}{8} = 8\frac{3}{8}$ the sum.

2. What is the sum of $\frac{3}{5}$ and $\frac{4}{5}$? *Ans.* $1\frac{2}{5}$.

3. What is the sum of $\frac{2}{7}$ and $\frac{5}{14}$? *Ans.* $\frac{9}{14}$.

4. What is the sum of $\frac{2}{3}$, $\frac{3}{5}$ and $\frac{5}{7}$? *Ans.* $1\frac{103}{105}$.

5. What is the sum of $\frac{5}{9}$, $\frac{3}{5}$ and $2\frac{1}{6}$? *Ans.* $3\frac{29}{90}$.

6. What is the sum of $\frac{3}{5}$. $\frac{4}{5}$ of $\frac{1}{3}$ and $9\frac{3}{20}$? *Ans.* $10\frac{1}{60}$.

7. What is the sum of $\frac{2}{3}$ of a pound, and $\frac{5}{9}$ of a shilling? *Ans.* $\frac{125}{9}$s, or 13s. 10d. $2\frac{2}{3}$qr.

8. What is the sum of $\frac{3}{5}$s. and $\frac{4}{15}$d.? *Ans.* $\frac{112}{15}$d, or 7d. $1\frac{13}{15}$qr.

9. What is the sum of £$\frac{1}{7}$, $\frac{2}{9}$s. and $\frac{5}{12}$d.? *Ans.* $\frac{3139}{1008}$s. or 3s. 1d. $1\frac{10}{21}$qr.

10. Suppose that I have $\frac{3}{8}$ of a ship, worth £1500, and that I buy another person's share of her, which is $\frac{5}{16}$; what part of her belongs to me then, and what is it worth? *Ans.* I have $\frac{11}{16}$, and it is worth £1031.5s.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

The same preparations being made here as in addition, take the difference of the numerators and set it over the common denominator, for the difference of the fractions required.

NOTE.—In subtracting mixt numbers, when the fraction in the subtrahend is greater than that in the minuend, subtract the numerator of the subtrahend from the denominator, and to the difference add the numerator of the minuend; and carry one to the integer in the subtrahend.

EXAMPLES.

1. What is the difference between $\frac{5}{6}$ and $\frac{1}{6}$?

$$\frac{5}{6} - \frac{1}{6} = \frac{5-1}{6} = \frac{4}{6} = \frac{2}{3} \text{ *Ans.*}$$

2. What is the difference between $\frac{15}{22}$ and $\frac{11}{17}$?

$$\frac{15}{22} \backsim \frac{11}{17} = \frac{255-242}{17 \times 22} = \frac{13}{374} \text{ *Ans.*}$$

3. What is the difference between $\frac{5}{12}$ and $\frac{7}{12}$?
Ans. $\frac{1}{6}$.

4. What is the diff. between $\frac{3}{13}$ and $\frac{4}{39}$? *Ans.* $\frac{5}{39}$.

5. What is the diff. between $\frac{5}{12}$ and $\frac{7}{13}$? *Ans.* $\frac{19}{156}$.

6. What is the difference between $5\frac{3}{8}$ and $\frac{2}{7}$ of $4\frac{1}{6}$?
Ans. $4\frac{31}{168}$.

7. What is the diff. between $\frac{5}{9}$ of a £ and $\frac{2}{3}$ of $\frac{3}{4}$ of a shilling? *Ans.* $\frac{191}{18}$s. or 10s. 7d. $1\frac{1}{3}$qr.

8. What is the difference between $\frac{2}{7}$ of £$5\frac{1}{6}$ and $\frac{3}{5}$ of a shilling? *Ans.* £$\frac{3037}{2100}$ or £1.8s. $11\frac{3}{35}$d.

9. Suppose that I have $\frac{5}{8}$ a of a ship which is worth £900 and that I sell $\frac{2}{3}$ of my share; what part of her have I left, and what is it worth? *Ans.* $\frac{5}{24}$; and worth £187 10s.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

Reduce mixt numbers, if there be any to fractions; then multiply all the numerators together for the numerator, and multiply all the denominators together for the denominator of the product required.

Note.—A fraction is best multiplied by an integer, by dividing the denominator by it; but if that cannot be done, multiply the numerator by it.

EXAMPLES.

1. What is the product of $\frac{2}{3}$, $3\frac{1}{4}$, 5, and $\frac{3}{4}$ of $\frac{3}{5}$?

1170 *Ans.*

$$\frac{2}{3}\times 3\tfrac{1}{4}\times 5\times\frac{3}{4}\text{ of }\frac{3}{5}=\frac{2\times 13\times 5\times 3\times 3}{3\times \underset{2}{4}\times 4\times 5}=\frac{39}{\underset{240}{8}}=4\tfrac{7}{8}.$$

2. What is the product of $\frac{2}{7}$ and $\frac{5}{8}$? *Ans.* $\frac{5}{28}$.
3. What is the product of $\frac{4}{15}$ and $\frac{5}{24}$? *Ans.* $\frac{1}{18}$.
4. What is the product of $\frac{3}{7}$, $\frac{4}{9}$ and $\frac{14}{15}$? *Ans.* $\frac{8}{45}$.
5. What is the product of $\frac{1}{2}$, $\frac{2}{3}$ and 3? *Ans.* 1.
6. What is the product of $\frac{3}{14}$ and 7? *Ans.* $1\frac{1}{2}$.
7. What is the product of $\frac{7}{9}$, $\frac{3}{5}$ and $4\frac{5}{14}$? *Ans.* $2\frac{1}{30}$.
8. What is the product of $\frac{5}{6}$ and $\frac{2}{3}$ of $\frac{6}{7}$? *Ans.* $\frac{10}{21}$.
9. What is the product of $5\frac{1}{3}$ and 9? *Ans.* 48.
10. What is the product of 6 and $\frac{2}{3}$ of 5? *Ans.* 20.
11. What is the product of $\frac{2}{9}$ of $\frac{3}{5}$ and $\frac{5}{8}$ of $3\frac{2}{7}$? *Ans.* $\frac{23}{84}$.
12. What is the product of $3\frac{2}{7}$ and $4\frac{14}{33}$? *Ans.* $14\frac{124}{231}$.
13. What is the product of 5, $\frac{2}{3}$, $\frac{2}{7}$ of $\frac{3}{5}$ and $4\frac{1}{6}$?

Ans. $2\frac{8}{21}$.

DIVISION OF VULGAR FRACTIONS.

RULE.

Having prepared the terms as in multiplication; take the quotient of the numerators and of the denominators,

if they will exactly divide, for the numerator and denominator of the fraction required; but if that cannot be done, multiply the dividend by the *reciprocal* of the divisor, for the quotient required.

NOTE 1.—By the reciprocal of a fraction, is meant the fraction got by inverting its terms; so the reciprocal of $\frac{2}{3}$, is $\frac{3}{2}$, and of 5 or $\frac{5}{1}$ is $\frac{1}{5}$.

NOTE 2.—A fraction is divided by an integer by dividing the numerator by it, if possible; but if it will not exactly divide, then multiply the denominator by it.

EXAMPLES.

1. What is the quotient of $\frac{25}{9}$ by $\frac{5}{3}$?

$$\frac{25}{9} \div \frac{5}{3} = \frac{25 \div 5}{9 \div 3} = \frac{5}{3} = 1\frac{2}{3} \textit{ Ans.}$$

2. What is the quotient of $5\frac{5}{9}$ by $\frac{2}{15}$?

$$\frac{5}{9} \div \frac{2}{15} = \frac{5}{9} \times \frac{15}{2} = \frac{\overset{5}{5 \times 15}}{\underset{3}{9 \times 2}} = \frac{\overset{75}{25}}{\underset{18}{6}} = 4\frac{1}{6} \textit{ Ans.}$$

3. What is the quotient of $\frac{16}{25}$ by $\frac{4}{5}$? *Ans* $\frac{4}{5}$.
4. What is the quotient of $\frac{7}{16}$ by $\frac{3}{4}$? *Ans.* $\frac{7}{12}$.
5. What is the quotient of $\frac{14}{9}$ by $\frac{7}{6}$? *Ans.* $1\frac{1}{3}$.
6. What is the quotient of $\frac{5}{6}$ by $\frac{15}{7}$? *Ans.* $\frac{7}{18}$.
7. What is the quotient of $\frac{12}{35}$ by $\frac{3}{5}$? *Ans.* $\frac{4}{7}$.
8. What is the quotient of $\frac{2}{7}$ by $\frac{3}{5}$? *Ans.* $\frac{10}{21}$.
9. What is the quotient of $\frac{9}{16}$ by 3? *Ans.* $\frac{3}{16}$.
10. What is the quotient of $\frac{3}{5}$ by 7? *Ans.* $\frac{3}{35}$.
11. What is the quotient of 5 by $\frac{7}{10}$? *Ans.* $7\frac{1}{7}$.
12. What is the quotient of $7\frac{1}{3}$ by $9\frac{5}{9}$? *Ans.* $\frac{33}{43}$.
13. What is the quotient of $\frac{2}{3}$ of $\frac{1}{3}$ by $\frac{5}{7}$ of $7\frac{3}{5}$. *Ans.* $\frac{7}{171}$.

INVOLUTION.

A power is a number produced by multiplying any given number continually by itself a certain number of times.

Any number is called the first power of itself: if it be multiplied by itself, the product is called the second power, and sometimes the square; if this be multiplied by the first power again, the product is called the third power, and sometimes the cube; and if this be multiplied by the first power again, the product is called the fourth power; and so on: that is, the power is denominated from the number which exceeds the multiplications by 1.

Thus: 3 is the first power of 3.
$3\times3=9$ is the second power of 3.
$3\times3\times3=27$ is the third power of 3.
$3\times3\times3\times3=81$ is the fourth power of 3.

And in this manner may be calculated the following table of powers.

TABLE,

OF THE FIRST NINE POWERS OF NUMBERS.

1s	2d	3d	4th	5th	6th	7th	8th	9th
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

NOTE 1.—The number which exceeds the multiplications by 1, is called the index, or exponent of the power: so the index of the first power is 1, that of the second power is 2, and that of the third is 3, &c.

NOTE 2.—Powers are commonly denoted by writing their indices above the first power; so the second power of 3 may be denoted thus 3^2, the third power thus 3^3, the fourth power thus 3^4, &c. and the 6th power of 503, thus 503^6.

Involution is the finding of powers, to do which, from their definition, there evidently comes this

RULE.

Multiply the given number, or first power, continually by itself, till the number of multiplications be 1 less than the index of the power to be found, and the last product will be the power required.

NOTE 1.—Whence, because fractions are multiplied by taking the products of their numerators and of their denominators, they will be involved by raising each of their terms to the power required. And if a mixt number be proposed, either reduce it to an improper fraction, or reduce the vulgar fraction to a decimal, and proceed by the rule.

NOTE 2.—The raising of powers will be sometimes shortened by working according to this observation, viz. whatever two or more powers are multiplied together, their product is the power whose index is the sum of the indices of the factors; or if a power be multiplied by itself, the product will be the power whose index is double of that which is multiplied; so if I would find the sixth power, I might multiply the given number twice by itself for the third power, then the third power into itself would give the sixth power; or if I would find the seventh power, I might first find the third and fourth, and their product will be the seventh; or lastly, if I would find the eighth power, I might first find the second, then the second into itself would be the fourth, and this into itself would be the eighth.

EXAMPLES.

1. What is the second power of 45? *Ans.* 2025.
2. What is the square of 4.16? *Ans.* 17.3056.
3. What is the square of .027? *Ans.* .000729.
4. What is the third power of 3.5? *Ans.* 42.875.
5. What is the 4th power of 71.8? *Ans.* 26576499.4576.
6. What is the 5th power of .029? *Ans.* .000000020511149.
7. What is the 6th power of 5.03? *Ans.* 16196.005304479729.
8. What is the second power of $\frac{2}{3}$? *Ans.* $\frac{4}{9}$.
9. What is the third power of $\frac{5}{9}$? *Ans.* $\frac{125}{729}$.
10. What is the square of $3\frac{2}{5}$? *Ans.* $\frac{289}{25}$ or 11.56.

EVOLUTION.

The root of any given number or power, is such a number, as being multiplied by itself a certain number of times, will produce the power; and it is denominated the first, second, third, fourth, &c. root, respectively, as the number of multiplications made of it to produce the given power is 0, 1, 2, 3, &c; that is, the name of the root is taken from the number which exceeds the multiplications by 1, like the name of the power in involution.

NOTE 1.—The index of the root, like that of the power in involution, is 1 more than the number of multiplications necessary to produce the power or given number.

NOTE 2.—Roots are sometimes denoted by writing $\sqrt{}$ before the power, with the index of the root against it; so the third root of 50 is $\sqrt[3]{50}$ and the second root of it is $\sqrt{50}$, the index 2 being omitted; which index is always understood when a root is named or written without one. But if the power be expressed by several numbers with the sign $+$ or $-$ between them, then a line is drawn from the top of the sign of the root, or radical sign, over all the parts of it; so the third root of 47—15 is $\sqrt[3]{4-15}$. And sometimes roots are designated like powers, with the reciprocal of the index of the root of the given number. So the root of 3 is $3^{\frac{1}{2}}$, the root of 50 is $50^{\frac{1}{2}}$, and the third root of it is $50^{\frac{1}{3}}$, also the third root of 47—15 is $\overline{47-15}^{\frac{1}{3}}$. And this method of notation has justly prevailed in the modern algebra; because such roots, being considered as fractional powers, need no other directions for any operations to be made with them, than those for integral powers.

NOTE. 3.—A number is called a complete power of any kind, when its root of the same kind can be accurately extracted; but if not, the number is called an imperfect power, and its root a surd or irrational quantity; so 4 is a complete power of the second kind, its root being 2; but an imperfect power of the third kind, its third root being a surd quantity.

Evolution is the finding of the roots of numbers, either accurately, or in decimals, to any proposed extent.

The power is first to be prepared for extraction, or evolution, by dividing it from the place of units, to the left hand in integers, and to the right in decimal fractions, into periods, containing each as many places of figures as are denominated by the index of the root, if the power contain a complete number of such periods: if it do not,

the defect will be either on the right hand, or left, or both; if the defect be on the right hand, it may be supplied by annexing cyphers, and after this whole periods of cyphers may be annexed to continue the extraction with, if necessary; but if there be a defect on the left, such defective period must remain unaltered, and is accounted the first period of the given number, just the same as if it were complete.

Now this division may be conveniently made by making a point over the place of units, and also over the last figure of every period on both sides of it; that is, over every second figure if it be the second root, over every third if it be the third root, &c.

Thus to point this number 21035896.12735;

for the second root, it will be $2\dot{1}0\dot{3}5\dot{8}9\dot{6}.1\dot{2}7\dot{3}5\dot{0}$;

but for the third root, thus $2\dot{1}03\dot{5}89\dot{6}.12\dot{7}35\dot{0}$;

and for the fourth, thus $2\dot{1}035\dot{8}96.1\dot{2}735\dot{0}00$;

NOTE.—The root will contain just as many places of figures as there are periods or points in the given power; and they will be integers, or decimals respectively, as the periods are so from which they are found, or to which they correspond; that is, there will be as many integer, or decimal figures in the root, as there are periods of integers or decimals in the given number.

TO EXTRACT THE SQUARE ROOT.

1. Having pointed the given number into periods of two figures each, find from the table of powers in page 308, or otherwise, a square number either equal to, or the next less than the first period, which subtract from it, and set the root of the square on the right hand side of the given number, after the manner of a quotient in division, for the first figure of the root required.

2. To the remainder annex the second period for a dividend; and on the left hand of it write the double of the root already found, after the manner of a divisor.

3. Consider what figure, which, if annexed to the divisor, and the result multiplied by it, the product may be equal to, or the next less than the dividend, and it will be the next figure of the root.

4. From the dividend subtract the product, and to the remainder bring down the next period, for a new dividend: to which as before, find a divisor by doubling the figures already found in the root; and from these find the next figure of the root, as in the last article; and continue the operation still in the same manner, till all the periods be used, or as far as you please.

Note.—When the root is to be extracted to a great number of places, the work may be much abbreviated thus: having proceeded in the extraction after the common method till you have found half the required number of figures in the root, the rest may be found by dividing the last remainder by its corresponding divisor, annexing a cypher to every dividual, as in division of decimals; or rather without annexing cyphers, by omitting continually the right hand figure of the divisor.

```
                 2(1.41421356237+root
                   1
                  ---
        24|100
         4| 96
        -------
       281| 400
         1| 281
       ---------
      2824| 11900
         4| 11296
      -----------
     28282| 60400
         2| 56564
     ------------
    282841| 383600
         1| 282841
    --------------
   2828423| 10075900
         3| 8485269
   ----------------
   2828426) 1590631(56237+
             176418
               6712
               1055
                206
                  8
```

EXAMPLES.

1. What is the root of 2025? *Ans.* 45.
2. What is the root of 17.3056? *Ans.* 4.16.
3. What is the root of .000729? *Ans.* .027.
4. What is the root of 3? *Ans.* 1.732050.

5. What is the root of 5? *Ans.* 2.236068.
6. What is the root of 6? *Ans.* 2.449489.
7. What is the root of 7? *Ans.* 2.645751.
8. What is the root of 10? *Ans.* 3.162278.
9. What is the root of 11? *Ans.* 3.316625.

RULES

For the square roots of Vulgar Fractions and Mixt Numbers.

First prepare all vulgar fractions by reducing them to their least terms, both for this and all other roots. Then

1. Take the root of the numerator and of the denominator for the respective terms of the root required. And this is the best way if the denominator be a complete power. But if it be not, then

2. Multiply the numerator and denominator together; take the root of the product; this root being made the numerator to the denominator of the given fraction, or made the denominator to the numerator of it, will form the fractional root required.

$$\text{That is, } \sqrt{\frac{a}{b}} = \frac{\sqrt{ab}}{b} = \frac{a}{\sqrt{ab}}$$

And this rule will serve whether the root be finite or infinite.

3. Or reduce the vulgar fraction to a decimal, and extract its root.

4. Mixt numbers may be either reduced to improper fractions, and extracted by the first or second rule; or the vulgar fraction may be reduced to a decimal, then joined to the integer, and the root of the whole extracted.

EXAMPLES.

1. What is the root of $\frac{25}{36}$? *Ans.* $\frac{5}{6}$.
2. What is the root of $\frac{27}{147}$? *Ans.* $\frac{3}{7}$.
3. What is the root of $\frac{9}{12}$? *Ans.* 0.866025.
4. What is the root of $\frac{5}{12}$? *Ans.* 0.645497.
5. What is the root of $17\frac{3}{8}$? *Ans.* 4.168333.

By means of the square root also we readily find the 4th root, or the 8th root, or the 16th root, &c; that is, the

root of any power whose index is some power of the number 2; namely, by extracting so often the square root as is denoted by that power of 2; that is, two extractions for the fourth root, three for the 8th root, and so on.

```
 .  .  .  .   .            .  .  .  .  .
 21035.8000          ( 145.037237(12.0431407 root.
 1                     1
 --                    --
 24|110               22| 45
  4| 96                2| 44
 ---------            ------------
 285|1435             2404|10372
   5|1425                4| 9616
 -------------        --------------
 29003|108000         24083| 75637
     3| 87009             3| 72249
 --------------       ---------------
 29006| 20991  ( 7237       3388 ( 1407
          687                980
          107                 17
           20
```

TO EXTRACT THE CUBE ROOT.

I. *By the Common Rule.*

1. Having divided the given number into periods of three figures each, find the nearest less cube to the first period, in the third line of the table of powers in page 308; set its root in the quotient, and subtract the said cube from the first period; to the remainder bring down the second period, and call this the *resolvend.*

2. To three times the square of the root, just found, add three times the root itself, setting this one place more to the right than the former, and call this sum the divisor. Then divide the resolvend, wanting the last figure, by the divisor, for the next figure of the root, which annex to the former; calling this last figure e, and the part of the root before found call a.

3. Add all together these three products, namely, thrice a squared multiplied by e, thrice a multiplied by e squared, and e cubed, setting each of them one place more to the right than the former, and call the sum the *subtrahend;* which must not exceed the resolved; and if it does, then make the last figure e less, and repeat the operation for finding the subtrahend.

4. From the resolvend take the subtrahend, and to the remainder join the next period of the given number for a new resolvend; to which form a new divisor from the whole root now found; and from thence another figure of the root, as directed in article 2, &c.

EXAMPLES.

To extract the cube root of 48228.544.

$$\begin{array}{lr|l}
 & 3\times3^2=27 & 48228.544(36.4 \text{ root.} \\
 & 3\times3\;=\;09 & 27 \\
\hline
\text{Divisor} & 279 & 21228 \text{ resolvend.}
\end{array}$$

$$\left.\begin{array}{rr}
3\times3^2\times6= & 162 \\
3\times3\;\times6^2= & 324 \\
6^3= & 216
\end{array}\right\}\text{add.}$$

$$\begin{array}{r|l}
3\times36^2=3888 & 19656 \text{ subtrahend.} \\
3\times36\;=\;108 & \\
\hline
38988 & 1572544 \text{ resolvend.}
\end{array}$$

$$\left.\begin{array}{rr}
3\times36^2\times4= & 15552 \\
3\times36\;\times4^2= & 1728 \\
4^3= & 64
\end{array}\right\}\text{add.}$$

$$\begin{array}{l}
1572544 \text{ subtrahend.} \\
\hline
0000000
\end{array}$$

III. *To extract the Cube Root by a short way.*

1. By trials take the nearest rational cube to the given cube or number, whether it be greater or less, and call it the assumed cube.

2. Then the sum of the given number and double the assumed cube, will be to the sum of the assumed cube and double the given number, as the root of the assumed cube, is to the root required, nearly. Or as the first sum, is to the difference of the given and assumed cube, so is the assumed root, to the difference of the roots, nearly.

3. Again, by using, in like manner, the cube of the root last found as a new assumed cube, another root will be got still nearer. And so on, as far as we please; using always the cube of the last found root, for the assumed cube.

EXAMPLES.

To find the Cube Root of 21035.8.

Here we soon find that the root lies between 20 and 30, and then between 27 and 28. Taking therefore 27, its cube is 19683 the assumed cube. Then

19683	21035.8		
2	2		
39366	42071.6		
21035.8	19683		
As 60401.8 :	61754.6 ::	27 :	27.6047
	27		
	4322822		
	1235092		

60401.8)1667374.2(27.6047 the root nearly.
459338
36525
284
42

Again for a second operation, the cube of this root is 21035.318645155823, and the process by the latter method will be thus:

21035.318645 &c.		
2		
42070.637290	21035.8	
21035.8	21035.318645 &c.	
As. 63106.43729 :	diff. .481355 ::	27.6047 :
	the diff.	.000210834
	conseq. the root req. is	27.604910834

TO EXTRACT ANY ROOT WHATEVER.

Let G be the given power or number, n the index of the power, A the assumed power r its root, R the required root of G.

Then as the sum of $n+1$ times A and $n-1$ times G, is to the sum of $n+1$ times G and $n-1$ times A, so is the assumed root r, to the required root of R.

Or, as half the said sum of $n+1$ times A and $n-1$ times G, is to the difference between the given and assumed powers, so is the assumed root r, to the difference between the true and assumed roots; which difference, added or subtracted, gives the true root nearly.

$$\text{That is, } \overline{n+1}.\,A+\overline{n-1}.\,G : \overline{n+1}.\,G+\overline{n-1}.\,A :: r : R.$$

$$\text{Or, } \overline{n+1}.\,\tfrac{1}{2}A+\overline{n-1}.\,\tfrac{1}{2}G : A \backsim G :: r : R. \backsim r.$$

And the operation may be repeated as often as we please, by using always the last found root, for the assumed root, and its nth power for the assumed power A.

Ex. To extract the 5th root of 21035.8.

Here it appears that the 5th root is between 7.3 and 7.4. Taking 7.3, its 5th power is 20730.71593. Hence then we have:

$$G = 21035.8;\ r = 7.3;\ n = 5;\ \tfrac{1}{2}.\overline{n+1} = 3;\ \tfrac{1}{2}.\overline{n-1} = 2$$

A = 20730.716

G—A=305.084

A=20730.716	G=21035.8
3	2
3 A=62192.148	42071.6
2 G=42071.6	

As. 104263.7 : 305.084 :: 7.3 : .0213605

```
                    305.084
                        7.3
                    -------
                     915252
                    2135588
                   --------
104263.7)2227.1132( .0213605 the diff.
           14184    7.3 = r add
            3758    -----------
             630    7.321360 = R the root true
               5                to the last figure.
```

OTHER EXAMPLES.

1. What is the 3d root of 2? *Ans.* 1.259921.
2. What is the 4th root of 2? *Ans.* 1.189207.
3. What is the 4th root of 97.41? *Ans.* 3.1415999.
4. What is the 5th root of 2? *Ans.* 1.148699.
5. What is the 6th root of 21035.8? *Ans.* 5.254037.
6. What is the 6th root of 2? *Ans.* 1.122462.
7. What is the 7th root of 21035.8? *Ans.* 4.145392.
8. What is the 7th root of 2? *Ans.* 1.104089.
9. What is the 8th root of 21035.8? *Ans.* 3.470323.
10. What is the 8th root of 2? *Ans.* 1.090509.

11. What is the 9th root of 21035.8? *Ans.* 3.022239.
12. What is the 9th root of 2? *Ans.* 1.080059.

GENERAL RULES

For extracting any root out of a Vulgar Fraction, or Mixt Number.

1. If the given fraction have a finite root of the kind required, it is best to extract the root out of the numerator and denominator, for the terms of the root required.

2. But if the fraction be not a complete power, it may be thrown into a decimal, and then extracted. Or,

3. Take either of the terms of the given fraction for the corresponding term of the root; and for the other term of the root, extract the required root of the product, arising from the multiplication of such a power of the first assigned term of the root whose index is less by 1 than that of the given power, by the other term of the given number. This rule will do when the root is either finite or infinite. That is, for any root n in general.

$$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \frac{\sqrt[n]{ab^{n-1}}}{b} = \frac{a}{\sqrt[n]{ba^{n-1}}}$$

4. Mixt numbers may be reduced either to improper fractions or decimals, and then extracted.

EXAMPLES.

1. What is the cube root of $\frac{8}{27}$? *Ans.* $\frac{2}{3}$.
2. What is the fourth root of $\frac{80}{405}$? *Ans.* $\frac{2}{3}$.
3. What is the cube root of $\frac{1}{2}$? *Ans.* .7937005.
4. What is the cube root of $2\frac{10}{27}$? *Ans.* $\frac{4}{3}$ or $1\frac{1}{3}$.
5. What is the third root of $7\frac{1}{5}$? *Ans.* 1.930979.

OF PROPORTION IN GENERAL.

NUMBERS are compared together to discover the relations they have to each other.

There must be two numbers to form a comparison: the number which is compared, being written first, is called the antecedent; and that to which it is compared, the consequent.

Numbers are compared to each other two different ways: the one comparison considers the difference of the two numbers, and is called arithmetical relation, the difference being sometimes named the arithmetical ratio; and the other considers their quotient, which is termed geometrical relation, and the quotient the geometrical ratio. So of these numbers 6 and 3, the difference or arithmetical ratio, is 6—3 or 3; and the geometrical ratio, is $\frac{6}{3}$ or 2.

NOTE.—Ratios are here always considered as the result of the greater term of comparison diminished, or divided, by the less, not regarding whether of them be the antecedent.

If two or more couplets of numbers have equal ratios, or differences, the equality is named proportion; and their terms, similarly posited, that is, either all the greater, or all the less taken as antecedents, and the rest as consequents, are called proportionals. So the two couplets 2, 4, and 6, 8, taken thus, 2, 4, 6, 8, or thus, 4, 2, 8, 6, are arithmetical proportionals; and the two couplets 2, 4, and 8, 16, taken thus, 2, 4, 8, 16, or thus, 4, 2, 16, 8, are geometrical proportionals.

To denote numbers as being geometrically proportional, the couplets are separated by a double colon, and a colon is written between the terms of each couplet: we may also denote arithmetical proportionals by separating the couplets with a double colon, and writing a colon turned horizontally between the terms of each couplet. So the above arithmeticals may be written thus, 2 .. 4 :: 6 .. 8, and 4 .. 2 :: 8 .. 6; where the first antecedent is less or greater than its consequent, by just as much as the second antecedent is less or greater than its consequent: and the geometricals thus, 2 : 4 :: 8 : 16, and 4 : 2 :: 16 : 8; where the first antecedent is contained in or contains its consequent, just as often as the second is contained in or contains its consequent. It is common to read the geometricals 4 : 2 :: 16 : 8, thus, 4 is to 2 as 16 to 8.

Proportion is distinguished into continued and discontinued.

If, of several couplets of proportionals placed in a series the difference or ratio of each consequent and the antecedent of the next following couplet, be the same as the common difference or ratio of the couplets, the proportion is said to be continued, and the numbers themselves a series of continued proportionals, or an arithmetical or geometrical progression. So 2, 4, 6, 8, form an arithmetical progression, for $4-2=6-4=8-6=2$; and 2, 4, 8, 16, a geometrical progression: for $\frac{4}{2}=\frac{8}{4}=\frac{16}{8}=2$.

But if the difference or ratio of the consequent of one couplet and the antecedent of the next couplet, be not the same as the common difference or ratio of the couplets, the proportion is said to be discontinued. So 4, 2, 8, 6, are in discontinued arithmetical proportion; for $4-2=8-6=2$: but $8-2=6$; also 4, 2, 16, 8 are in discontinued geometrical proportion; for $\frac{4}{2}=\frac{16}{8}=2$, but $\frac{16}{2}=8$.

If the succeeding terms of a progression exceed each other, it is called an ascending progression or series; if the contrary, a descending series.

So { 0, 1, 2, 3, 4, &c. is an ascending arithmetical series,
1, 2, 4, 8, 16, &c. is an ascending geometrical series,

and { 4, 3, 2, 1, 0, &c. is a descending arithmetical series,
16, 8, 4, 2, 1, &c. is a descending geometrical series.

The first and last terms of a progression are called the extremes; and the other terms, the means.

ARITHMETICAL PROGRESSION.

An arithmetical progression is a series, of which the succeeding terms are either all greater, or all less than their adjacent preceding terms, by the same number or difference.

NOTE.—The fundamental property of an arithmetical progression from which almost all of its other properties are deducible, and which evidently follows from its construction, is, that the sum of any two of its terms, is equal to the sum of any other two terms, taken at an equal distance, but on contrary sides of the former; or that the double of any one term, is equal to the sum of any two terms taken at an equal distance, from it on each side.—And of any two couplets in discontinued arithmetical proportion, the two sums are equal which are made by adding the antecedent of each to the consequent of the other.

PROBLEM I.

Given one of the extremes, the common difference, and the number of terms of an arithmetical series; to find,

1. The other extreme.

RULE.

Multiply the common difference by 1 less than the number of terms; then add the product to the least term, and the sum will be the greatest, or subtract it from the greatest term, to give the least.

2. The sum of all the terms of the series.

RULE.

Multiply the sum of the extremes by the number of terms, and half the product will be the sum of the series.

Thus, if a represent the less extreme,
z the greater,
d the common difference,
n the number of terms,
s the sum of the series;

$$\text{then}\left\{\begin{array}{l} z=a+d\times\overline{n-1}. \\ \\ a=z-d\times\overline{n-1}. \end{array}\right. \quad \text{and} \quad \left\{\begin{array}{l} s=\dfrac{2a+dn-d}{2}\times n, \\ \\ s=\dfrac{2z-dn+d}{2}\times n \end{array}\right.$$

EXAMPLES.

1. Given the least term 3, the common difference 2, and the number of terms 9; to find the greatest term and the sum of the series? *Ans.* $\left\{\begin{array}{l}\text{the greatest term is 19, and}\\ \text{the sum of the series is 99.}\end{array}\right.$

2. If the greatest term be 70, the common difference 3, and the number of terms 21; what is the least term, and the sum of the series?

Ans. { The least term is 10, and the sum is 840.

3. A debt can be discharged in a year, by paying 1 shilling the first week, 3 shillings the second, and so on, always 2 shillings more every week; what is the debt, and what will the last payment be?

Ans. { The last payment will be £5 3s., and the debt is £135.4s.

4. One hundred stones being disposed on the ground in a straight line, at a distance of a yard from each other; how many yards will a person travel who shall bring them all, one by one, to a basket placed one yard from the first stone?

Ans. { 10100yds, or 5mls. 1300yds, or nearly 5¾mls.

PROBLEM II.

Given the extremes and the common difference; to find,

1. The number of terms.

RULE.

Divide the difference of the extremes by the common difference, add 1 to the quotient, and the sum will be the number of terms.

2. The sum of the series.

Having found the number of terms, the sum of the series will be had by the second case of problem 1.

Thus, using the same symbols as before,

$$n=\frac{z-a}{d}+1, \text{ and } s=\overline{a+z}\times\frac{z-a+d}{2d}$$

EXAMPLES.

1. If the extremes be 3 and 19, and the common difference 2; what is the number of terms, and the sum of the series?

Ans. { The number of terms is 9, and the sum is 99.

2. If the extremes be 10 and 70, and the common difference 3; what is the number of terms, and the sum of the series?

Ans. { The number of terms is 21, and the sum is 840.

3. What debt can be discharged, and in what time, supposing the first week the payment be 1s., and the payments every week following to increase by 2s., till the last payment be £5 3s.

Ans. { The debt is £135 4s., and it will be discharged in a year or 52 weeks,

PROBLEM III.

Given the extremes and the number of terms; to find,

1. The common difference.

RULE.

This is found by dividing the difference of the extremes by 1 less than the number of terms.

2. The sum of the series.

This is had from the 2d case of problem I.

$$\text{Thus, } d = \frac{z-a}{n-1}, \text{ and } s = \frac{a+z}{2} \times n.$$

EXAMPLES.

1. If the extremes be 3 and 19, and the number of terms 9; what is the common difference, and the sum of the series?

Ans. { The difference is 2, and the sum is 99.

2. If the extremes be 10 and 70, and the number of terms 21; what is the common difference, and the sum of the series?

Ans. { The difference is 3, and the sum is 840.

3. What debt can be discharged in a year by weekly payments in arithmetical progression, whereof the first term or payment is 1s., and the last term £5 3s.; and what is the common difference of the series of payments?

Ans. { The difference is 2s., and the debt is £135 4s.

GEOMETRICAL PROGRESSION.

A Geometrical Progression is a series of numbers, of which the succeeding terms are either all greater or all less than their adjacent preceding terms, in such sort, that the ratio or quotient of every two adjacent terms is the same.

NOTE.—The same thing is true with respect to the products of the terms of a geometrical proportion, as was observed of the sums of the terms of an arithmetical proportion, in the note in page 322. That is, the product of any two terms, is equal to the product of any other two terms, taken at an equal distance, but on contrary sides of the former; or that the square of any one term, is equal to the product of any two terms, taken at an equal distance from it on each side. And the same analogy holds good in most of their problems; so that many of their rules are almost verbally the same, and differ only in this, that instead of the operations of addition, subtraction, multiplication, and division in arithmetical progression, are required respectively those of multiplication, division, involution, and evolution, in geometrical progression.

PROBLEM I.

Given one of the extremes, the ratio, and the number of the terms of a geometrical series; to find,

1. The other extreme.

RULE.

Raise the ratio to the power whose index is one less than the number of terms; by which multiply the last term to give the greatest, or divide the greatest term to find the least.

2. The sum of the series.

RULE.

Divide the difference of the extremes by the ratio less 1, to the quotient add the greater extreme, and it will give the sum of the series. Or multiply the greatest term by the ratio, from the product subtract the least term, then divide the difference by the ratio less 1, and the quotient will be the sum of the series.

Thus, if a represents the least term,
z the greatest,
r the ratio,

n the number of the terms, and
s the sum of the series;

then $\begin{cases} z = a \times r^{n-1} \\ a = z \div r^{n-1} \end{cases}$ and $\begin{cases} s = \dfrac{r^{n}-1}{r-1} \times a \\ s = \dfrac{r^{n}-1}{r-1} \times \dfrac{z}{r^{n-1}} \end{cases}$

EXAMPLES.

1. Given the least term 1, the ratio 2, and the number of terms 10; what is the greatest term and the sum of the series?

Ans. { The greatest term is 512, and the sum 1023.

2. If the greatest term be 885735, the ratio 3, and the number of terms 12, what is the least term, and the sum of the series?

Ans. { The least term is 5, and the sum 1328600.

3. What debt will be discharged in a year or 12 months by paying £1 the first month, £2 the second, £4 the third, and so on, each succeeding payment being double the last; and what will the last payment be?

Ans. { The debt is £4095, and the last payment £2048.

PROBLEM II.

Given the extremes and the ratio; to find,

1. The sum of the series.

This is found by the second case of the last problem.

2. The number of terms.

RULE.

Divide the greatest term by the least; find what power of the ratio is equal to the quotient; then add 1 to the index of that power, and the sum will be the number of terms. Or, divide the difference of the logarithms of the extremes, by the logarithm of the ratio, add 1 to the quotient, and the sum will be the number of terms.

$$\text{Thus, } s = \frac{z-a}{r-1} + z = \frac{rz-a}{r-1}; \text{ and}$$

$$n = \frac{\log. z - \log. a}{\log. r} + 1 = \frac{\log. z - \log. a + \log. r.}{\log. r}$$

EXAMPLES.

1. If the extremes be 1 and 512, and the ratio 2, what is the sum of the series, and the number of terms?

Ans. { The sum is 1023, and the number of terms 10.

2. If the extremes be 5 and 885735, and the ratio 3: what is the sum of the series, and the number of terms?

Ans. { The sum is 1328600, and the No. of terms 12.

3. What debt will be discharged by monthly payments in geometrical progression, the first of which is £1, and the last £2048, the ratio being 2; and in what time will it be discharged?

Ans. { The debt is £4095, and it will be dis. in a year.

PROBLEM III.

Given the extremes and the number of terms; to find,

1. The ratio.

This is found as in problem 2, by dividing the greater extreme by the less, and extracting the root of the quotient whose index is 1 less than the number of terms.

2. The sum of the series.

This is found as in problem 1.

$$\text{Thus, } r = \sqrt[n-1]{\frac{z}{a}}; \text{ and } s = \frac{\sqrt[n-1]{z^n} - \sqrt[n-1]{a^n}}{\sqrt[n-1]{z} - \sqrt[n-1]{a}}$$

EXAMPLES.

1. Given the extremes 1 and 512, and the number of terms 10; to find the ratio and the sum of the series.

Ans. { The ratio is 2, and the sum is 1023.

2. If the extremes of a series, consisting of 12 terms, be 5 and 885735; what is the ratio, and the sum of the series?

Ans. { The ratio is 3, and the sum is 1328600.

3. What debt can be discharged in a year by monthly payments, in geometrical progression, of which the first payment is £1, and the last £2048; and what will the ratio of the series be?

Ans. { The ratio will be 2, and the debt £4095.

SINGLE POSITION.

This rule is also called False Position, or false supposition, because it makes a supposition of false numbers, as if they were the true ones, and by their means discovers the true numbers sought.

The single rule uses only one supposition, but the double rule two; whence come their names.

To the rule of position belong such questions as cannot be resolved by the direct process by any of the former rules; and in which ~~the required number or numbers~~ do not ascend above the first power; such, for example, as most of the questions usually brought to exercise the reduction of simple equations in algebra. But it will not bring out true answers when the numbers sought ascend above the first power; for then the results are not proportional to their positions, nor the errors to the difference of the true number and each position; yet in all such cases it is a very good approximation, and in exponential equations, as well as many other things, succeeds better than perhaps any other method.

Those questions, in which the results are proportional to their suppositions, belong to single position; such are those which require the multiplication or division of the number sought by any number, or in which it is to be increased or diminished by itself any number of times, or by any part or parts of it. But those in which the results are not proportional to their positions, be-

long to the double rule; such are those, in which the number sought is increased or diminished by some given number, which is no known part of the number required.

To work Questions in Single Position.

Take any number, and perform the same operations with it as, in the question, are described to be performed with the number sought; then if the result be the same with that in the question, the supposed number is the number sought; but if it be not, say, as the result of the operation, is to the position, so is the result in the question, to the number required.

EXAMPLES.

1. A person after spending $\frac{1}{3}$ and $\frac{1}{4}$ of his money, has yet remaining £60; what had he at first?

Suppose he had at first £120.	*Proof.*
Now $\frac{1}{3}$ of 120 is 40	$\frac{1}{3}$ of 144 is 48
$\frac{1}{4}$ of it is 30	$\frac{1}{4}$ of 144 is 36
their sum is 70	their sum 84
which taken from 120	taken from 144
leaves 50	leaves 60 as per question.

Then 50 : 120 :: 60 : 144, the *Ans.*

2. What number is that, which multiplied by 7, and the product divided by 6, the quotient may be 14? *Ans.* 12.

3. What number is that, which being increased by $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of itself, the sum shall be 125? *Ans.* 60.

4. A general after sending out a foraging $\frac{1}{2}$ and $\frac{1}{3}$ of his men, had yet remaining 700; what number had he in command? *Ans.* 4200.

5. A gentleman distributed 78 pence among a number of poor people, consisting of men, women and children; to each man he gave 6d, to each woman 4d, and to each child 2d: moreover there were twice as many women as

men, and thrice as many children as women. How many were there of each ? *Ans.* 3 men, 6 women and 18 children.

6. One being asked his age, said, if $\frac{3}{5}$ of the years I have lived, be multiplied by 7, and $\frac{2}{3}$ of them be added to the product the sum will be 292. What was his age ? *Ans.* 60 years.

DOUBLE POSITION.

Having taken any two convenient numbers, for the positions, proceed with each, according to the conditions of the question, as if they were the true numbers sought; and find how much the results are different from the result in the question. Next multiply each of these errors or differences by the other's position; then if the errors be of the same affection, that is, if the results be both either too great or too little, divide the difference of the products by the difference of the errors, and the quotient will be the answer: but if the errors be of different affections, that is, if one result be too great and the other too little, divide the sum of the products by the sum of the errors, and the quotient will be the answer.

Or having found the errors, say, As the sum of the errors, when they are of different kinds, or as the difference of the errors, when they are of the same kind, is to the difference of the suppositions, so is the least error, to the correction of the supposition belonging to this error; which must be added to, or subtracted from it, according to the following conditions, viz. if the errors be of the same kind, add the correction to this supposition if it is greater than the other supposition, or subtract when it is the less; but if the errors be of different kinds, do the contrary, viz. add when that supposition is the less, and subtract when it is the greater of the two; and the sum or difference will be the number sought.

EXAMPLES.

1. What number is that, which being multiplied by 6, the product increased by 18, and the sum divided by 9, the quotient will be 20;

First, suppose 30 to be the number sought.

Then $\dfrac{30\times6+18}{9}=10\times2+2=20+2=22$; but ought to be 20; therefore the error is 2 in excess.

Again, suppose 18 to be the number sought.

Then $\dfrac{18\times6+18}{9}=2\times6+2=12+2=14$; but ought to be 20; therefore the error is 6 in defect.

And the errors are of different kinds or affections.

Whence, by the first rule, $\dfrac{30\times6+18\times2}{2+6=8}=\dfrac{15\times3+9}{2}$ $=\frac{54}{2}=27$ the number sought.

And by the second rule, $2+6 : 30-18 :: 2\dfrac{2\times12}{8}=$ 3, the correction; then $30-3=27$, the number sought.

2. A son asking his father how old he was, receives the following answer: your age is now $\frac{1}{4}$ of mine; but 5 years ago your age was only $\frac{1}{5}$ of mine at that time.—What are their ages? *Ans.* 80 and 20.

3. A workman was hired for 30 days, at 2s. 6d. per day, for every day he worked; but with this condition, that for every day he played, he should forfeit 1s. Now it so happened, that upon the whole he had £2 14s. to receive. How many of the days did he work?

Ans. 24.

4. A and B began to play together with equal sums of money: A first won 20 guineas, but afterwards lost back $\frac{2}{3}$ of what he then had; after which B had 4 times as much as A. What sum did each begin with?

Ans. 100 guineas.

5. Two persons, A and B, have both the same income, A saves $\frac{1}{5}$ of his; but B, by spending £50 per annum more than A, at the end of 4 years finds himself £100 in debt. What does each receive and spend per annum?

Ans. { They receive £125 per ann.; also A spends £100, and B spends £150 pr. ann.

THE END.